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ERRATA, VOLUME XI

Page 9, 13th line from the bottom, read *carolinensis* for *caroliniana*.

Page 10, 5th line from the bottom, capitalize C in *Cannon*.

Page 12, 6th line from the bottom, read *Byrsonima* for *Brysonema*.

Page 95, 11th line from the bottom, read *Crotonopsis* for *Chrotonopsis*.

Page 95, 10th line from the bottom, after *Panicum* read § for ‖.

Page 95, 12th line from the bottom after *Aster* read ‖ for §.

Page 96, the first five names in the list should precede the four in the second column on page 95.

Page 99, 4th line from the top, read *is* for *are*.

Page 190, last line, read *vegetation* for *vegegation*.

Page 191, 15th line from the top, read *Haberer* for *Harberer*.

Page 194, 7th line from the bottom, read *east* for *west*.

Page 196, 17th and 21st lines from the top, read *Pensauken* for *Penausken*.

Page 203, 15th line from the bottom, read *flowers* for *plants*.

Page 236, 3d line from the bottom, read *Dukinfield* for *Deunkinfield*.

Page 242, 14th line from the bottom, read *Anthurus* for *Arcturus*.

Page 248, 13th line from the bottom, read *R. A. Harper* for *R. H. Harper*.

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No. 3.	March	51–76	March 21, 1911
No. 4.	April	77–100	April 19, 1911
No. 5,	May	101–124	May 17, 1911
No. 6,	June	125–144	June 19, 1911
No. 7,	July	145–164	July 19, 1911
No. 8,	August	165–180	August 14, 1911
No. 9,	September	181–204	September 12, 1911
No. 10,	October	205–224	October 18, 1911
No. 11,	November	225–248	November 10, 1911
No. 12,	December	249–276	December 20, 1911

TORREYA

January, 1911

Vol. 11 No. 1

THE FUNKIAS OR DAY-LILIES

By George V. Nash

Many years ago, past the middle of the eighteenth century, that indefatigable explorer and botanist, Thunberg, visited Japan. During his travels in that then almost unknown country, he found a perennial plant which was of frequent occurrence, both wild and under cultivation. In those days of broadly drawn generic lines, Thunberg without hesitation referred his plant to the Linnaean genus *Aletris*, under the specific name of *japonica*. Some years later, in 1784, he transferred this to the genus *Hemerocallis*, perhaps a nearer approach to its true relationship as understood today; but it was not until 1807 that the first intimation was made that the group to which this plant belonged might be the basis of a new genus, and the name of *Saussurea* was very indefinitely proposed for it by Salisbury. The form in which this proposition was made could not possibly be considered as publication under the rules of nomenclature of the present day. In any event, it is not available, as the name *Saussuria* had been previously employed by Moench for an entirely different group of plants. In 1812 Trattinick proposed the name of *Hosta*, ignoring the fact that Jacquin fifteen years earlier had used it for a genus of the Verbenaceae. These earlier names being disposed of the way is clear for the adoption of the *Niobe* of Salisbury, published in the same year as *Hosta*, and about which the question of priority might have been raised, had not Trattinick's name proved a homonym. Salisbury adequately published his name, it being based on *Hemerocallis japonica* Ker. In spite of this, however, the name of *Funkia*, under which these plants are generally known and which was not published by Sprengel until 1817, is adopted in the Index Kewensis. This arbitrary usage is perhaps responsible for the wide

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acceptance of this name and the continuation of the error. That this name must be abandoned and that of *Niobe* reinstated, is well supported by the above facts.

The genus divides itself into two rather well-marked groups which were considered genera by Salisbury, under the names of *Niobe* and *Bryocles*. The former was applied to the plant known here as *Niobe plantaginea*, in which the flowers are white and have the filaments adnate to the tube for part of their length, while the name of *Bryocles* was given to what is here called *Niobe coerulea*, a group including at the present time several other species, in which the flowers are smaller, colored, and have the filaments free. It is said that in *Niobe plantaginea* there is present a small bracteole at the base of the pedicel, but I find this frequently wanting, so attach little value to it as a generic character. In view of the above, I find it better to adopt the generally accepted view of the present day, and consider the two groups as parts of one genus.

The genus may be briefly characterized as follows:

Niobe Salisbury, Trans. Hort. Soc. 1: 335. 1812

Bryocles Salisbury, l. c.

Hosta Tratt. Arch. Gew. 1: 55. 1812. Not Jacq. 1797.

Funkia Spreng. Anl. Ed. 2, 2^1: 246. 1817.

Libertia Dum. Comm. 9. 1822.

Tufted perennial herbs, forming large masses, with petioled basal leaves, and a racemose inflorescence borne on a naked or leafy stem. Perianth varying from white to deep lavender, tubular-trumpet-form, funnel-form, or campanulate-funnel-form: segments six, shorter or longer than the tube. Stamens six, declinate, from equalling to a little shorter than the perianth, the filaments filiform and free or nearly so, or adnate to the tube for a considerable part of their length: anthers oblong, versatile, introrse. Ovary sessile, oblong, 3-celled. Style filiform, a little thickened at the stigma. Ovules numerous. Capsule narrowly oblong or almost linear, loculicidally 3-valved. Seeds compressed, angled, or almost flat.

Species seven or eight, perhaps more, natives of Japan, China, and eastern Siberia.

The following key will help identify the six species in cultivation:

Perianth white, 8–10 cm. long, tubular-trumpet-form; stamens adnate to the tube for a considerable portion of their length. 1. *N. plantaginea.*

Perianth colored, 3–6 cm. long, stamens free.

Perianth funnel-form, the tube gradually passing into the limb, from white flushed with lavender to pale lavender.

Flowering stem with leaves or with leaf-like bracts, these gradually passing into the bracts of the inflorescence; leaf-blades green.

Leaf-blades lanceolate to ovate-lanceolate, usually equally narrowed at both ends, the nerves on each side of the midrib 3–5; perianth usually less than 5 cm. long. 2. *N. japonica.*

Leaf-blades broadly ovate, the nerves on each side of the midrib 6–10; perianth usually 5 cm. long or more. 3. *N. undulata.*

Flowering stem naked, or sometimes with a single bract at the middle; leaf-blades glaucous.

Scape not or but little exceeding the leaves; petioles usually much exceeding the blades. 4. *N. Sieboldiana.*

Scape much exceeding the leaves; petioles usually not exceeding the blades. 5. *N. Fortunei.*

Perianth campanulate-funnel-form, the tube abruptly passing into the limb, blue. 6. *N. coerulea.*

1. **Niobe plantaginea** (Lam.). White Day-lily. Plantain Lily

Hemerocallis plantaginea Lam. *Niobe cordifolia* Salisb. *Funkia subcordata* Spreng. *Funkia alba* Sweet. *Funkia grandiflora* Sieb. & Zucc.

A showy perennial, with large plantain-like leaves, and racemes of white odorous flowers. Leaves numerous, pale green; blades 15–23 cm. long, 8–13 cm. wide, broadly ovate, cordate at the base, acute at the apex, with 6–8 curved nerves on each side of the midrib; petiole usually exceeding the blade in length: scape 4–6 dm. tall, with 1 or 2 lanceolate bracts near the middle: inflorescence racemose, 1–2 dm. long: flowers up to about 12, each in the axil of an ovate bract 3–4 cm. long, on pedicels 1–2 cm. long: perianth about 1 dm. long, white, its lobes ovate or lanceolate, 3–4 cm. long, but little spreading; stamens shorter than the perianth: capsule about 2 cm. long.

A native of Japan and China. Lamarck, who described this plant under the name of *Hemerocallis plantaginea* in 1789, thought that it had been growing for a few years in the garden of the king, to which it had been sent by M. de Guines from China. This is the first reference found to its cultivation outside of its native country, so its introduction to gardens may be taken as occurring somewhere near that date. It is known in Japan as

"tamano kandsaki." The variety *grandiflora* (*Funkia grandiflora* Sieb. & Zucc.) appears to differ only in the somewhat larger flowers, and in having the bracts of the raceme larger and more leaf-like.

From an inspection of the list of synonymy cited above, it will be seen that this plant has had many names. It has frequently been considered the *Hemerocallis japonica* of Thunberg's Flora Japonica, on account of the flowers of that plant being described as white. Thunberg, however, states that in his plant the filaments are attached to the base of the corolla at the edge of the ovary, a condition not existing in the plant here under consideration, in which these parts are adnate to the perianth tube for a considerable portion of its length. Thunberg may have had a pale-flowered form of the plant considered in this paper as *N. japonica*. The name under which this plant is commonly known in gardens in this country and in those of Europe is *Funkia subcordata*, a name descriptive of the shape of the leaves, but not more so than is that of *plantaginea*, here adopted, which refers to the resemblance of these leaves to those of the common plantain of Europe, *Plantago major*, a resemblance striking indeed.

2. **Niobe japonica** (Thunb.). Japanese or Lance-leaved Day-lily

Aletris japonica Thunb. *Funkia lancifolia* Spreng.

A showy perennial forming large dense masses, with elliptic to nearly ovate leaf-blades which are narrowed at the base, and racemes of lavender flowers. Leaves numerous, green: blades 10–15 cm. long, sometimes up to 6 cm. wide, lanceolate or elliptic to ovate-lanceolate, usually equally narrowed at both ends, rarely more broadly so at the base, with 3–5, rarely more, curved nerves on each side of the midrib: scape 4–6 dm. tall, overtopping the leaves, the scattered and distant leaves gradually passing into the bracts of the inflorescence: inflorescence racemose: flowers sometimes up to 20, finally nodding, on pedicels 4–6 mm. long: perianth pale lavender, 3–5 cm. long, the slender tube, less than one half the length of the perianth, narrowed into a broad limb, the segments 1.5–2 cm. long and 8–10 mm. wide, acute: capsule 2.5–3 cm. long, pendulous and appressed to the scape.

A native of Japan. There is a variegated form in cultivation

known as variety *albo-marginata* (*Funkia albomarginata* Hook.), which has the leaves margined with a narrow band of white. There is another form which is quite distinct, the variety *tardiflora*, in which the pedicels are longer, the lower ones 10–12 mm. long. It also flowers a little later, so that while the one is in ripe fruit, this variety is still in flower. It is also more resistant to frost.

The synonymy of this plant has perhaps been more tangled than in any other member of the genus, and it was in part the fault of Thunberg himself. In his Flora Japonica, published in 1784, he described a *Hemerocallis japonica*. Previous to this, in 1780, he had published an *Aletris japonica*, but in the Flora Japonica he made no reference to this. As in the later publication he quotes verbatim in part the description given of his *Aletris*, it is quite easy to connect the two. Subsequent to the publication of *Hemerocallis japonica* Thunb., Kaempfer's Icones Selectae Plantarum appeared, published in 1791, and at plate 11 of this work appeared another *H. japonica*, an entirely different plant from that of Thunberg. In 1794 Thunberg renames his plant, calling it *Hemerocallis lancifolia*, and maintains Kaempfer's name for a plant, which, years afterward, was called *Funkia Sieboldiana* by Hooker. It is difficult to understand why Thunberg did this, unless it be that he associated this plate with the description of a plant published by the same author in 1712, but without a binomial. In the Botanical Magazine, under plate 1433, this same association is made. The flowers are there said to be 3 inches long, which hardly agrees with the plate cited in which the flowers are shown to be about 2 inches long—about the size they are in the plant named *Funkia Sieboldiana* by Hooker. This is of course interesting only as a matter of history, for the oldest specific name of this plant published with a description is *japonica*, and this must be adopted.

3. **Niobe undulata** (Otto & Dietr.). Wavy-margined Day-lily

Funkia undulata Otto & Dietr.

A tall showy plant, with long-petioled broad leaves, and numerous pale lavender flowers in a long raceme. Stems up

to 1.5 m. tall, bearing 3–5 long-petioled leaves which gradually decrease in size, passing into the bracts of the inflorescence; basal leaves numerous; petioles often more than twice as long as the blades, deeply concave, thin-margined, up to 4.5 dm. long; blades usually 1.5–2 dm. long, up to 13 cm. wide, undulate on the margins, broadly ovate, acute at the apex, abruptly narrowed into the margined petiole, with 6–10 nerves on each side, the nerves depressed above, very prominent beneath, the upper surface dull, the lower shining: raceme up to 5 dm. long: flowers numerous, nodding, on recurved pedicels less than 1 cm. long; perianth 4.5–5.5 cm. long, funnel-form, pale lavender, the narrowly ovate acute segments about one half as long as the tube, the stamens and style recurved at the apex, the former exserted.

A native of Japan. There is a plant, much lower than this, with smaller more strongly undulate leaf-blades, which are marked with large masses of white in the center, and a fewer-flowered raceme. I venture to consider this a variegated form of the above plant, under the name *Niobe undulata variegata.* It is perhaps the most commonly cultivated of all the day lilies, and is frequently used as an edging for paths. Its flowers are identical with those of the above in color, form and size, and they appear at about the same time. The stem is also leafy as in that plant. This is sometimes considered a form of *Niobe japonica*, but that flowers considerably later, and has differently shaped leaves with fewer nerves—characters which would seem to exclude this variegated form.

4. **Niobe Sieboldiana** (Lodd.). Siebold's Day-lily

Funkia Sieboldiana Hook. *Funkia Sieboldii* Lindl. *Funkia sinensis* Sieb.

A showy pereninal forming large masses, with large cordate glaucous leaves, and racemes of pale lilac flowers which protrude little if any above the leaves. Leaves numerous: petioles 2–3 dm. long; blades 2–3 dm. long and 15–20 cm. wide, broadly ovate, cordate at the base, acute at the apex, glaucous on both surfaces, with 12 or 13 curved nerves on each side of the midrib: scape, including the raceme, 3–4 dm. tall, barely equalling or little exceeding the leaves, the lower bracts 4–8 cm. long, finally spreading: inflorescence racemose; flowers 10–15, on pedicels 10–12 mm. long,

finally nodding: perianth pale lilac or white flushed with the same color, 5–6 cm. long, the segments about 1.5 cm. long and 6–8 mm. wide: capsule 3–3.5 cm. long.

Native of Japan. Introduced into cultivation at the Botanical Garden at Leyden, Holland, in 1830.

5. **Niobe Fortunei** (Baker). Fortune's Day-lily

Funkia Fortunei Baker.

A showy perennial, forming masses, with pale green glaucous leaves, which are much overtopped by the racemes of pale purple flowers. Leaves numerous: petioles 5–8 cm. long, shorter than the blades; blades 10–13 cm. long and 7–9 cm. wide, pale green, glaucous, cordate at the base, cuspidate at the apex, with 10–12 nerves on each side of the midrib: scape, including the raceme, 4–5 dm. long, much overtopping the leaves: raceme 1–1.5 dm. long, the bracts lanceolate, the lower ones about 2.5 cm. long: flowers on pedicels 6–8 mm. long: perianth pale purple, about 4 cm. long, the segments lanceolate and about one half as long as the tube.

Native of Japan. Introduced into cultivation in 1876. This and *N. Sieboldiana* are frequently confused.

6. **Niobe coerulea** (Andr.). Blue Day-lily

Hemerocallis coerulea Andr. *Funkia ovata* Spreng. *Funkia coerulea* Sweet.

A showy perennial forming large masses, with large cordate or ovate leaves, and racemes of blue flowers. Leaves numerous, green; blades 10–25 cm. long, 8–13 cm. wide, broadly ovate or sometimes cordate at the base, acute at the apex, the margin often wavy, with 6–9 curved nerves on each side of the midrib; petiole up to 30 cm. long: scape 3–6 dm. tall: inflorescence racemose, extending much above the leaves, the bracts 2 cm. long or less: flowers up to 12, on pedicels 5–10 mm. long, finally nodding: perianth pale or deep blue, 4–5 cm. long, the tube, less than one half the length of the perianth, abruptly spreading into a broad ample limb, the segments of which are about 2 cm. long and 8–10 mm. wide, acute: capsule pendulous, 24–36 mm. long.

Native of Japan, northern China, and eastern Siberia. It was first introduced some time prior to 1797 into England from Japan by Mr. G. Hibbert, of Clapham, in whose garden it flowered. It was first cultivated as a hothouse plant, but was later found to be hardy.

This, as was the case with *Niobe plantaginea*, was first published as a *Hemerocallis* in 1797. By some this is considered to be the original *Hemerocallis japonica* of Thunberg's Flora Japonica; but in that the leaves are said to have seven nerves, making this position hardly tenable, as the leaves in this have from 13–19. This is usually known under the name of *Funkia ovata* Spreng. There are forms of this also with variegated leaves. The variety *albo-marginata* has the leaves margined with white.

A word now as to the uses of these plants in horticulture, to which they lend themselves readily and effectively. By selecting the species, flowers may be had continuously from June to the time of frost. The first to flower are *Niobe Sieboldiana* and *N. Fortunei*, closely related species, which are at their prime in June, with white flowers flushed with lavender. As these are waning the deeper lavender flowers of *Niobe undulata* and its variegated variety make their appearance, late in June or early in July, accompanied at almost the same time by the blue bell-shaped flowers of *Niobe coerulea*. Next to appear are the flowers of *Niobe japonica*, and its later-flowering form, the variety *tardiflora*, which carry the flowering period of this interesting genus up to the time of killing frosts. Accompanying these last, and perhaps the most stately of them all, is *Niobe plantaginea*, sometimes known as the plantain lily, from the resemblance of its leaves to those of that plant. This is quite in contrast with the other species, the flowers being much larger, of a different shape, and a pure white, with no trace of coloring. They appear usually early in September, and continue through the month.

Some of the day lilies are desirable foliage plants, in addition to the interest of their flowers. For those who like the rich variegated effect of white and green, perhaps no other plant is more effective than is *Niobe undulata variegata*, planted as an edging to paths or beds. Where a mass of deep green foliage is desired, *Niobe undulata* and *N. coerulea* are desirable; or if a gray green is wished, *Niobe Sieboldiana* or its close relative *N. Fortunei* should not be forgotten. The plants spread rapidly, and delight in a deep rich soil, free from soggy conditions, and are impartial to the bright sun or part shade. Masses of them

planted in the corner of a garden or in recesses in a herbaceous border are very effective. They may be readily propagated by division of the old plants, the new ones soon developing into masses rivaling those from which they were taken. They may also be readily grown from seed, which some of them produce freely. It is desirable, however, that the seed be sown soon after collecting, as it does not keep well.

All of the species in cultivation are perfectly hardy in the latitude of New York, requiring no protection whatever, making them especially desirable for a herbaceous border, where permanency is a great desideratum.

New York Botanical Garden.

ADDITIONS TO THE FLORA OF THE CAROLINAS—II

By W. C. Coker

Kalmia cuneata Michx.

This species occurs plentifully on the edge of an open savanna on the south side of Prestwood's Lake, Hartsville, S. C. It appears in scattered slumps along the transition line between the savanna and a typical dense "bay" formation. The soil it stands in is a nearly saturated black humus, and is covered in many places with *Sphagnum*. Associated with the *Kalmia* are *Zenobia pulverulenta*, *Vaccinium australe*, *Azalea viscosa*, *Ilex glabra*, *Ilex coriacea*, *Aronia arbutifolia*, *Myrica cerifera*, *Myrica caroliniana*, *Xolisma foliosiflora*, *Fothergilla carolina*, *Pieris nitida*, etc.

It has been taken previously only from southeastern N. C. The New York Botanical Garden and the Gray Herbarium have it only from Bladen Co., N. C. The Biltmore Herbarium has it also from Cumberland Co. (Hope Mills), and Moore Co. (Aberdeen), N. C.

Pyxidanthera barbulata Michx.

Forms dense and extensive mats at several places in the sand hills north of Hartsville, S. C., *e. g.*, on the Camden road about four miles from town. It grows in very sandy soil associated with such plants as arbutus (*Epigaea repens*) and wire grass (*Panicum neuranthum*). It was known heretofore only from

New Jersey and from southeastern North Carolina. This is one of the most beautiful and interesting of sandy plants.

Mayaca fluviatilis Aubl.

Plentiful in Prestwood's Lake, Hartsville, S. C. Its range has heretofore been given as the Gulf States and Tropical America. The plant grows in delicate, loosely woven masses, quite submerged and, in company with *Myriophyllum heterophyllum*, *Utricularia fibrosa*, *Utricularia biflora*, *Potamogeton diversifolius*, and *P. heterophyllus*.

Helianthemum canadense (L.) Michx.

This is found on sand hills near Kilgore's branch, Hartsville, S. C. April 14, 1910. Typically northern in its range, this plant has not been reported before below North Carolina. It was collected at Florence, S. C., by L. F. Ward (Herb. N. Y. Bot. Garden), and the Biltmore herbarium has it from Florence, S. C., and from near Augusta, Ga.

Pentstemon australis Small.

Dry, poor soil. Chapel Hill, N. C., May 14, 1910. Low, sandy flats, Hartsville, S. C., May 6, 1910. Heretofore published only from the Gulf States and westward, but the Biltmore herbarium has it from Dade City, Fla., Augusta, Ga., and southeastern North Carolina.

Baptisia villosa (Walt.) Ell.

Collected on sand hills across lake, Hartsville, S. C. May 22, 1910, and on sand hills near Kilgore's branch, Hartsville, S. C., April 14, 1910. Heretofore published only from Virginia and North Carolina of the seaboard states and extending westward to Arkansas; but Dr. John K. Small has collected it in Walton Co., Florida.

Rubus betulifolius Small.

Occurs on south side of Prestwood's Lake on the cannon place, April 23, 1910, in flower. Heretofore listed only from Georgia and Alabama, but in the herbarium of the New York Botanical Garden there is a sheet by Gibbs from Cooper River, S. C., that is referred to this species.

Rubus Enslenii Tratt.

In good soil in woods, Laurel Land, Hartsville, S. C. April 24, 1910. This is the one-flowered plant considered by some a form of *R. procumbens*, and I can find no record of its occurrence in South Carolina. The typical *R. procumbens* is found in Chapel Hill, N. C., where it forms dense mats in wet places.

Carex texensis (Torr.) Bailey.

It covers the ground under trees, in the yard of Dr. A. A. Kluttz, Chapel Hill, N. C. So far it has not been published from either of the Carolinas, but Homer D. House has collected it at Clemson College, S. C. It is now known from Southern Illinois to the Carolinas, Georgia, and westward.

This plant makes a good substitute for grass on lawns that are damp and densely shaded.

Oenothera Drummondii Hook.

This beautiful evening primrose was collected in very sandy soil along the trolley way on Sullivan's Island, S. C., Aug. 28, 1909. It has been collected from this island before (Herbarium of the New York Botanical Garden) and from Ormond, Florida (Gray Herbarium) but I cannot find that it has been reported from South Carolina or Florida, or indeed collected from any other of the Southern States east of Texas.

Chapel Hill, North Carolina.

ADDITIONS TO THE TREE FLORA OF THE UNITED STATES

By John K. Small

In several previously published papers* I recorded a number of trees new to silva of the United States. They were brought to light through exploration in southern Florida, and are as follows: *Serenoa serrulata*, *Quercus Rolfsii*, *Chrysobalanus pellocarpus*, *Alvaradoa amorphoides*, *Suriana maritima*, *Cicca disticha*, *Mangifera indica*, *Rhus leucantha*, *Ilex Krugiana*, *Hibiscus Rosa-*

*Bull. N. Y. Bot. Gard. **3**: 419–440: Torreya **7**: 123–125; Bull. Torrey Club **37**: 513–518.

sinensis, *Tetrazygia bicolor*, *Sapota Achras*, *Solanum verbascifolium*, and *Genipa clusiifolia*. The following additions were discovered during more recent exploration in southern Florida.

ANONA PALUSTRIS L.

The ALLIGATOR APPLE grows abundantly in open moist hammocks on Long Key (Everglades) and in similar situations west of Camp Jackson (Small & Wilson no. 1648). The plants are easily distinguished from those of *Anona glabra*, which is common in southern Florida, by the flowers; these are usually only about one half the size of those of *Anona glabra* and have more pointed sepals and petals. The outer petals, too, are much longer than the inner ones.

ANONA SQUAMOSA L.

The preceding species, *Anona palustris*, like *Anona glabra*, is native in Florida. On the contrary, the SUGAR APPLE, *Anona squamosa*, is most likely an introduced species. While collecting on Lower Metacumbe Key, Florida, in August, 1907, I found specimens of this species thoroughly naturalized in hammocks on different parts of the island. Exploration on other keys long under cultivation would probably yield further stations for this species.

CAPPARIS CYNOPHALLOPHORA L.

The BAY-LEAVED CAPER TREE although common in southern peninsular Florida and on the keys seems to be but rarely encountered as a tree. The writer had the good fortune to find it in January, 1909, growing as a tree on both Soldier Key and Key Largo. In both localities it reached a height of about twenty-five feet. Mr. Blodgett found it many years ago on Key West growing to a height of twenty feet.

BRYSONIMA LUCIDA (Sw.) DC.

The LOCUST-BERRY, although known to reach the proportions of a tree in the West Indies, in Florida has heretofore been known only as a shrub, and usually a rather small shrub. However, it was found on several of the small keys at the southwestern extremity of the Everglade Keys growing as a tree in January,

1909, by Mr. Carter and the writer. The maximum height it attained was about twenty-five feet.

Colubrina Colubrina (L.) Millsp.

The several collections of the Wild Coffee, made both on the keys and the mainland of Florida appear not to have revealed it in any form but a shrub. Mr. Blodgett records it as a shrub on Key West reaching a height of twelve feet. During more recent exploration in the Everglades Mr. Carter and the writer found it on the main island of the Long Key group as a small shrub. During the fall of 1904 the writer found it very common in hammocks about the middle of the homestead country, some fifteen miles southwest of Cutler. Trees thirty to forty feet tall and six to eight inches in diameter were not uncommon.

Paritium tiliaceum (L.) Juss.

The Mahoe, an old world plant established on the Florida Keys for many years, did not reach the proportions of a tree or become established on the mainland, except perhaps in cultivation, until the present century. In 1905 Mr. S. H. Richmond sent me specimens from trees growing in the shore-hammock near Cutler. These trees evidently sprung from seeds brought there by some natural means from the keys. Although this is the only record we have of the tree occurring on the mainland, it is to be expected along the shore of the bay at any point between Cutler and Cape Sable. While in Miami in the summer of 1907 Mr. Richmond gave me additional specimens from the same station.

Lucuma nervosa A. DC.

The Egg Fruit has evidently been a naturalized member of our flora for a number of years. This fact was brought to light after the severe hurricane which swept over southern peninsular Florida and the upper keys during the fall of 1906. The wind and flood during this storm swept the forests of Elliott's Key clean of the under brush and thus allowed easy access to portions of the hammocks which were hitherto almost inaccessible. At different points in the forest we found fine trees which had evi-

dently become established there many years ago, while young trees were springing up from seed produced by the older trees.

HAMELIA PATENS Jacq.

The HAMELIA grows in hammocks in the southern two thirds of peninsular Florida and in the hammocks of the Florida Keys, but it seems never to have been observed except as a shrub. However, the writer has found specimens on the Everglade Keys growing in the dense hammocks between Cocoanut Grove and Cutler, reaching a height of 20 feet and with a trunk diameter of fully 6 inches.

NEW YORK BOTANICAL GARDEN.

TRAGOPOGON PRATENSIS × PORRIFOLIUS

BY EARL E. SHERFF

So far as the writer can find, the presence in the United States of hybrids between our two well-known species of salsify, *Tragopogon pratensis* L. and *T. porrifolius* L., has not heretofore been observed with certainty. Britton and Brown* state that "an apparent hybrid between . . . [these two species] . . . has been noticed at New Brunswick, N. J." But more recently, Britton† omits mention of this "apparent" hybrid and, similarly, Gray's New Manual‡ fails to record it.

That there exists, however, within the two species in question a potentiality for hybridization, was demonstrated by Linnaeus§ as early as 1759. By removing the pollen of *T. pratensis* and placing upon the stigmas some pollen from *T. porrifolius* he secured hybrids with an intermediate color scheme in the flowers. Instead of the yellow peculiar to *T. pratensis* or the purple peculiar to *T. porrifolius*, the heads of the hybrid exhibited both red and yellow. These colors were somewhat approximated later in spontaneous hybrids observed by J. Lange|| in the Danish

*Illustrated Flora, p. 269. 1898. New York.

†Man. of Flora of Northeastern States and Canada. 1905. New York.

‡Gray's New Manual. 1908. New York.

§Amoenitates academicae, X., p. 126. 1790. Erlangen.

||See Focke, Pflanzen Mischlinge, p. 222. 1881. Berlin.

islands of Fünen and Laaland. The outer flowers were "brown-violet, the inner yellow."

During the month of June, 1910, it was the writer's privilege to make frequent observations upon both *T. porrifolius* and *T. pratensis* along the right-of-way of the C. M. & St. P. R. R. at Elgin, Ill. For a distance of several hundred feet the two species were abundant, the former occurring in the northern half of the tract and the latter in the southern half. Where the two kinds met, there were found not only plants of each species but also some thirty or more plants quite distinct. In size, the last plants more nearly resembled *T. porrifolius*, which in that vicinity was considerably the more robust plant. The flowers possessed, to a remarkable extent, the color pattern observed by Lange in the hybrids of Fünen and Laaland; the outer flowers of each head being a reddish "brown-violet" and the inner a yellow color. The involucral bracts were mostly equal in length to the ray flowers. A remarkable uniformity prevailed in the flower-colorations, size of the mature plants, and proportionate length of the bracts. Individual plants were examined from time to time and in no case were they found to bear pure yellow or pure purple heads. However ramose the plant, its several branches produced heads with uniformly the outer flowers reddish brown-violet and the inner flowers yellow.

It thus becomes obvious that these plants were nothing more or less than hybrids between the two species that abounded in either direction. It is the more obvious because they were found growing only in a small restricted area of about three square rods where the two pure stocks met.

Evanston, Illinois.

SHORTER NOTES

A New Gerardia from New Jersey.—**Gerardia racemulosa.** —Stem slender, 3–6 dm. tall, striate-angled, smooth, branched. Branches slender, elongated, ascending. Leaves narrowly linear to filiform, sparingly scabrous above, those of the stem 1.5–2.5 cm. long, 0.5–1.5 mm. broad, usually curling on drying, with conspicuous clusters in the axils. Inflorescences strongly racemose.

Pedicels 3 mm. long. Calyx-tube campanulate, 3 mm. high, its lobes triangular-subulate to subulate, 0.8–2.0 mm. long. Corolla rose-purple, about 20 mm. long, its lobes spreading, pubescent at base of upper lobes, purplish-spotted below within throat. Capsule ellipsoid-globose, 4–4.5 mm. in diameter.

Type—Parkdale, Camden Co., N. J., F. W. Pennell 2692 Coll. Sept. 27, 1910, in Herb. Acad. Nat. Sci. of Phila.

Moist sphagnous depressions, Pine Barrens of New Jersey; apparently also of North Carolina.

Specimens seen:

New Jersey—Hornerstown, Monmouth Co., *J. H. Grove* 318; Pasadena, Ocean Co., *B. Long;* Forked River, Ocean Co., *B. Long;* Egg Harbor, Atlantic Co., *J. B. Brinton*, *A. MacElwee*, *C. Mohr*, *C. L. Pollard*, *H. H. Rusby;* Parkdale, Camden Co., *F. W. Pennell* 2692, 2694.

North Carolina—Wilmington, *G. McCarthy* 47.

This plant must be considered as an offshoot of *Gerardia purpurea* L. (abundant through most of the Atlantic Coastal Plain), adapted to, and largely replacing that species in the peculiar environment of the Pine Barren region of New Jersey. The two forms seem quite distinct, and for their better understanding a diagnostic comparison is given. The characterization of *G. purpurea* L. represents the normal form of the plant as occurring about Washington, D. C., on the lower Susquehanna River in Pennsylvania, in Delaware, and in New Jersey.

Stem rather stout, 4–9 dm. tall, usually sparingly scabrellous; branches stiff, spreading; leaves linear or broadly linear, those of the stem 3–5 cm. long, 1.5–3.5 mm. broad, not curling on drying; inflorescences not strongly racemose; calyx-lobes triangular-lanceolate to triangular-subulate; corolla mostly 25–30 mm. long; capsule globose, mostly 6–7 mm. in diameter. *G. purpurea* L.

Stem slender, 3–6 dm. tall, smooth; branches slender, elongated, ascending; leaves narrowly linear to fili orm, those of the stem 1.5–2.5 cm. long, 0.5–1.5 mm. broad, usually curling on drying; inflorescences strongly racemose; calyx-lobes triangular-subulate to subulate; corolla about 20 mm. long; capsule ellipsoid-globose, 4–4.5 mm. in diameter . . . . *G. racemulosa.*

Francis W. Pennell.

University of Pennsylvania.

Notes on some Californian Green Algae.—An examination of Collins' recent work on the green algae (F. S. Collins, "The Green Algae of North America," Tufts College Studies **2**: 79–480. *pl. 1–18.* 1909) showed that two very characteristic species which have been collected in central California were not recorded for this state.

The first species is a *Spondylomorum*, probably *S. quaternarium* Ehrenb., the only recognized species of the genus, of which there seems to be no previous record for America. According to Wille (Volvocaceae, Engler & Prantl, Die Natürlichen Pflanzenfamilien, **1**²: 40. 1890), this species occurs only in Europe and Asia.

In 1896, Dr. W. R. Shaw, then instructor at Stanford University, collected at Pacific Grove, near Monterey, a quantity of this species. He made a number of slides, three of which are now in the collection of the University. The specimens agree in all respects with the figures and descriptions of *S. quaternarium*, but are somewhat smaller than the dimensions given by De-Toni in his Sylloge Algarum, where the size is stated to be 36–75μ. The largest Californian specimens hardly exceed 40μ in length. No further collections of *Spondylomorum* have come to my attention.

The second alga to be noted is *Pithophora oedogonia* (Mont.) Wittrock. This species has been collected several times in Felt Lake, a small body of water some four miles from Stanford University. The identification was made by Professor W. A. Setchell.

The species of *Pithophora* are for the most part tropical, but several species have been reported from stations in the eastern and central parts of the United States. So far as I know, the genus has not before been recorded from the Pacific Coast.

Douglas H. Campbell.

Stanford University, California.

REVIEWS

Hough's Leaf Key to the Trees

A little book of interest to teachers that has appeared recently is Mr. R. B. Hough's Leaf Key to the Trees.*

*R. B. Hough. Leaf Key to the Trees of the United States and Canada, and a Botanical Glossary, pp. 1–49. Published by the author, at Lowville, New York, Sept., 1910 Price $.75

The book is "aimed to include all the generally accepted native and naturalized trees north of the latitude of the northern boundary of North Carolina, and east of the Rocky Mountains." The key as drawn up is based on the normal typical leaves, "such as we consider distinctive of the various species and by which we recognize them," . . . "the average specimens on a mature tree, not those on very young or excessively vigorous shoots." Fruit characters are also included in connection with some of the trees "either as essential or accessory parts of the key; though many species can readily be traced without referring to the fruits." The book is intended to supplement the more extensive publications on native trees,—"to enable one to have in a compact and systematic form an aid in the identification of trees by a study of their leaves". The value of this little book to teachers lies in its availability as an aid for field work for older secondary students and for college students. Work on the identification of plants has a disciplinary value much higher than the amount of time usually devoted to it would seem to indicate. Trees offer probably by far the best medium for such work because of their size and usually the corresponding saliency of their distinctive characters, and also because of the greater interest attaching to them than to less conspicuous plants. Of course the value of any particular key for class work will depend in the end upon its workability in actual service, but those who are familiar with Mr. Hough's Handbook will not question his very high qualifications for the preparation of a practicable key. As a matter of fact an examination of his treatment of some of the difficult genera shows that it is as good as would be expected. The differentiation of the species of oak is particularly good. One omission there is which detracts somewhat from the ready usefulness of the key—this is the failure to cite any of the varying different distributions of the trees. So for the oaks, a resident of Massachusetts seeking to identify a red oak would have to decide between four species, one of which is native farther south but which, at least in leaf characters, the red oak may at times resemble. For example I have in mind two large oaks with large flat-saucered acorns growing in the Litchfield hills in

northwestern Connecticut, the leaves of which might key out at *Q. digitata*, a southern species. If, however, the range of *digitata* were indicated, its elimination would have been instant.

For many trees, however, this difficulty will not present itself and the book may be heartily recommended. Its size, about five by six and one half inches, and its flexible cover make it a convenient book to carry in the field.

Ralph C. Benedict.

Stevens' Diseases of Economic Plants

A new book entitled Diseases of Economic Plants, by F. L. Stevens and J. G. Hall,* of the North Carolina Agricultural Experiment Station, has recently appeared. This work is designed to meet the needs of those students who wish to recognize, wherever this can be done with any degree of certainty, and treat diseases of plants without the laborious process of a detailed microscopic study. Those characters are used in diagnosing diseases which are evident to the naked eye or through the aid of the hand lens, and technicalities are avoided so far as possible, thus making the text a usable one to the agricultural students of the lower grade. The work is confined mainly to the bacterial and fungous diseases.

The introductory chapters contain a brief historical sketch of the development of the science of phytopathology; also statistics regarding the damage caused by fungi, symptoms of disease, methods of preventing diseases, formulae of the various fungicides with directions as to the best methods of applying them, and a discussion of the cost and profit resulting from their use.

The body of the work is devoted to a description of the symptoms of the diseases of plants which are of economic importance with directions as to the best methods of controlling them. These diseases are classified according to the natural relationship of the hosts on which they occur and all of the diseases of a given host are treated under that host regardless of the relationships of the fungi which cause the diseases. The terms used in desig-

*Stevens, F. L., & Hall, J. G. Diseases of Economic Plants. Pp. i–ix + 1–513. *f. 1–214.* The Macmillan Co., New York, 1910. Price $2.00.

nating the various diseases are those most commonly used or where these are lacking or ambiguous a name is made by adding the termination "ose" to the generic name of the fungus which causes the disease. The work is thoroughly illustrated, the illustrations being of such a nature as to be of material aid in the diagnosis of the various diseases.

The appendix contains a brief discussion of the differences in the physiology of the chlorophyl-bearing and chlorophylless plants with a few of the most striking morphological characters of the bacteria and fungi. This part of the work is very brief.

One of the points on which the work is to be commended is the fact that the manuscript of the various parts has been submitted to the best specialists in the groups treated for corrections and criticism, thus eliminating many of the errors which might otherwise appear in a work of this kind and ensuring accuracy as to details. The book will doubtless meet the need of a large number of students, especially in our agricultural colleges.

F. J. Seaver.

Dr. J. A. Harris (Biometrika, November) presents an exhaustive study "On the selective elimination occurring during the development of the fruits of *Staphylea*." The author, keeping in mind the very different problem of the selective elimination of individuals, has striven to show the morphological and physiological value of the selective elimination of certain types of organs produced by individuals. Using statistical methods, now familiar through the work of Francis Galton and Karl Pearson, he recapitulates (in part), after presenting detailed tables of 21,000 locules and their ovules, thus:

"The ovaries with relatively low numbers of ovules are more extensively eliminated than those with high numbers." "The ovaries which remain after elimination are more radially symmetrical than those which are eliminated." "Ovaries with one or more locules with an 'odd' number of ovules are more likely to be eliminated than those with all the locules bearing an 'even' number." "Dimerous ovaries seem less likely, and tetramerous ovaries more likely to develop to maturity than the normal trimerous ones."

So far as the last statement is concerned, the selective elimination there recorded must be of very recent origin, for tetramerous ovaries of the bladder-nut are the exception rather than the rule. And if the elimination continues ever so slowly tetramerous ovaries of the bladder-nut must eventually become perfectly normal abnormalities.

N. T.

PROCEEDINGS OF THE CLUB

November 8, 1910

The meeting was called to order at the American Museum of Natural History at 8:30 P. M., with Dr. E. B. Southwick in the chair. Forty-six persons were present. The minutes of the meeting of October 26 were read and approved.

The announced paper of the evening on "The Native Trees of Northeastern United States" was then presented by Mr. Norman Taylor. The lecture was illustrated by lantern slides.

Adjourned.

Percy Wilson,
Secretary.

NEWS ITEMS

The Naples Table Association for promoting Laboratory Research by Women wishes to call attention to the opportunities for research in zoölogy, botany and physiology provided by the foundation of this table. The year of the Association begins in April and all applications for the year 1911–12 should be sent to the Secretary on or before *March first, 1911*. The appointments are made by the Executive Committee.

A prize of $1,000 has been offered periodically by the Association for the best thesis written by a woman, on a scientific subject, embodying new observations and new conclusions based on an independent laboratory research in biological, chemical or physical science. The fourth prize will be awarded in April, 1911. Application blanks, information in regard to the advantages at Naples for research and collection of material, and circulars giving

the conditions of the award of the prize will be furnished by the Secretary, Mrs. A. D. Mead, 283 Wayland Avenue, Providence, R. I.

At the New York Botanical Garden, Dr. Arthur Hollick has gone to Washington on a six month's leave of absence to study Alaskan fossils, and Dr. J. A. Shafer and Mr. Percy Wilson have gone to eastern and western Cuba respectively to continue the botanical exploration of that island. Volume 6, no. 22, of the BULLETIN, containing descriptions of many new Bolivian plants by Dr. H. H. Rusby, was issued 30 of November. Volume 3, part 1 of North American Flora appeared 29 of December. It contains the order by Hypocreales.

The college entrance examination board at its recent meeting appointed the following to prepare examination questions in botany for 1911. W. W. Rowlee, Cornell, chief examiner, M. E. Kennedy, Mount Holyoke, and Louis Murbach, Detroit, associates.

In the recently issued second edition of "American Men of Science," the editor, Prof. J. McKeen Cattell, as the result of an elaborate statistical study, ranks the five leading institutions in the following order of botanical eminence: Harvard, New York Botanical Garden, U. S. Dept. Agriculture, Chicago University, and Cornell University.

Dr. Charles E. Bessey, professor of botany and dean at the University of Nebraska, has been elected president of the 1911 Meeting of the A. A. A. S. to be held at Washington, beginning December 27, 1911.

The Botanical Society of America has elected professor W. G. Farlow, of Harvard University, as its president for 1911.

TORREYA

February, 1911

Vol. 11 No. 2

THE NATURE AND FUNCTION OF THE PLANT OXIDASES*

By Ernest D. Clark

One of the most noteworthy characteristics of living organisms is their ability to carry out many deep-seated chemical changes without the ordinary means of producing such reactions. In other words, the living cell is a laboratory equipped to provide the most varied chemical transformations, yet with none of the relatively crude and violent agents such as high temperatures and strong chemicals which we are forced to use in the test-tube experiments of our man-made laboratories. In no case is this power of the cell more striking than in the oxidative phenomena of plants and animals; the latter especially are continually oxidizing and transforming large amounts of material for the maintenance of their life, and yet these oxidations are accompanied by few of the physical effects associated with oxidation and combustion in daily life or in the laboratory. It is not surprising, then, that the attention of biologists and chemists was early attracted to the investigation of biological oxidations. Beginning with Schoenbein in the fourth decade of the last century, and continuing to the present, numerous have been the theories advanced in regard to these phenomena. However, before proceeding with a discussion of the factors involved in the oxidations of the plant, it is desirable to indicate the means which the cell

* This paper is based on the author's dissertation entitled "The Plant Oxidases," which was published last year in partial fulfilment of the requirements for the degree of Ph.D. in Columbia University.

[No. 1, Vol. 11, of Torreya, comprising pp. 1–22, was issued 31 Ja 1911.]

has at its disposal for carrying out its chemical reactions with such wonderful efficiency.

The fermenting action of certain bacteria and yeasts upon sugars and other substances has long been known and used in the industries. These yeasts were called *organized* ferments, while chemical preparations like pepsin, etc., which exhibit a fermenting or digesting action, were called *unorganized* ferments. This distinction was retained until 1897 when Buchner performed his classical experiment on yeast, showing that by the action of pressure applied in a hydraulic press he was able to obtain a liquid possessing all the fermenting power of living yeast plants even in the absence of the living organisms. This substance or property of the expressed liquid Buchner called an "enzyme." He said that substances of like nature were products of the life-activities of cells, but were *not* dependent on the *living* cell for the exhibition of their characteristic fermenting action. It is to ferments or enzymes like this that the cell owes its great chemical efficiency. Enzymes are members of the class of substances known as "catalyzers" which, by processes that are not fully understood, cause reactions to take place with a speed not shown under ordinary conditions. Generally, catalysts are capable of causing or assisting in reactions without being themselves destroyed by the processes they propagate.

In discussing the oxidases or oxidizing enzymes a somewhat critical attitude is necessary in the face of many conflicting and even contradictory results. To take an example, several of the so-called oxidizing enzymes have been shown to be not enzymes but heat-withstanding inorganic or organic catalyzers. At the present time our knowledge of these substances is being increased almost daily, with the result that we are now in a sort of transitional period, the literature of the whole subject being filled with assertions and denials on the part of equally able investigators. The tendency at present seems to be to consider as enzymes those apparently complex organic substances of non-diffusable nature and of high catalytic power, which are produced during the life processes of plants and animals; but when investigation reveals *definitely* their exact chemical nature, such

as the "laccase" of alfalfa, which Euler and Bolin[1] have recently proved to be calcium salts of simple organic acids, then they are referred to as organic catalysts. Bearing this in mind, the writer will use the terms oxidizing enzyme and oxidase interchangeably for convenience and with no implication that they are enzymes according to the strictest definition, or that future investigation may not prove the action of all the classes of oxidizing enzymes to be due to the same substance or property.

In regard to the rôle and the nature of many of the oxidases, we are still ignorant in spite of the study that has been devoted to them. In the case of enzymes like pepsin, trypsin, and lipase, investigation has produced considerable advances in our knowledge of them, but this cannot be said of the oxidases. In fact, there are doubts in some cases whether certain of the oxidases are enzymes at all, because a number of them have been proved to be comparatively simple organic or inorganic substances. However, such oxidases as peroxidase and tyrosinase still hold their places in the category of enzymes. In classifying the oxidases several arrangements have been suggested, many of which led only to confusion. After 1903, a more accurate classification was proposed, for it was then that Bach and Chodat[2] showed that the so-called oxidases of Bertrand are really composed of three separate parts as indicated below:

1. Oxygenase; a preformed organic peroxide resulting from auto-oxidation.

2. Peroxidase; a true enzyme which activates the oxygenase or added H_2O_2, etc.

3. Catalase; a substance decomposing H_2O_2 into $H_2O + O_2$. Since 1903, a great deal of work has been done which shows that this conception of the so-called oxidases is founded on fact.

[1] Euler and Bolin. Zur Kenntniss biologische wichtiger Oxydationen:

(*a*) I. (Same title as the series, Zur Kenntniss, etc.), Zts. Physiol. Chem. **57**: 80. 1908.

(*b*) II. Ueber die Reindarstellung der *Medicago* laccase, Zts. Physiol. Chem. **1**: 1. 1909.

[2] Bach and Chodat. Zerlegung der sogenannte Oxydasen in Oxygenasen und Peroxydasen—V. Ber. Chem. Gesell. **36**: 606. 1903.

In the last edition of Oppenheimer's "Die Fermente"[3] he has adopted the following classification of the plant oxidases, which will be used in this paper:

1. Laccase; phenolase, etc.
2. Tyrosinase, melanin-forming enzymes.
3. "Oxidases."
    (*a*) Oxygenase.
    (*b*) Peroxidase.
4. Catalase.

Laccase

Schoenbein's interest in the problems of oxidation led him to investigate the cause of the coloration of certain mushrooms, and in 1856[4] he published his results. In *Boletus luridus* he found a substance soluble in alcohol that showed the same bluing from injury of the fungus or on treatment with oxidizing agents in the test-tube, that characterizes the bluing of the guaiac tincture; moreover, the same substances decolorize this blued extract as in the case of the blued guaiac tincture. Schoenbein saw the importance of the fact that spontaneous bluing *only* took place in the fungus *itself*, and concluded therefore that there was a substance present in the fungus with power to greatly increase the oxidizing power of the atmospheric oxygen. In *Agaricus sanguinareus* he was also able to find the same sort of spontaneously coloring substance that he noted in *Boletus luridus*. He concluded that, besides the chromogenic substance of these fungi, there is a substance present that can ozonize (activate) atmospheric oxygen; he called such an activating substance a "Sauerstofferreger," or literally an "oxygen-exciter."

The first really careful work on oxidizing ferments was done by Yoshida[5] who, in 1883, investigated the chemistry of lacquer.

[3] Oppenheimer. Die Fermente und ihre Wirkungen, "Die Oxydasen," chap. 7, pp. 337–391, Spezielle Teil, 3d ed. 1909. Also for an excellent treatment of oxidases in general see:

Kastle. The Oxidases. Bull. 59, Hyg. Lab. U. S. Pub. Health and Mar. Hosp. Serv. Washington, 1910.

[4] Schoenbein. Ueber die Selbstblauung einige Pilze, etc. Jour. Prakt. Chem. **67**: 496. 1856.

[5] Yoshida. Chemistry of Lacquer. Jour. Chem. Soc. **43**: 472. 1883.

The lacquer-work of the Japanese has long been a famous and beautiful product of that country. The milky latex of the tree *Rhus vernicifera*, rapidly oxidizes in a moist atmosphere to a black lustrous varnish which is not attacked by any chemical except concentrated nitric acid. In the latex Yoshida found a substance having the composition $C_{14}H_{18}O_2$ which he called urushic acid; besides this, he found a small amount of a nitrogenous constituent, "a peculiar diastatic matter," which rapidly caused the urushic acid to oxidize to the black oxyurushic acid ($C_{14}H_{18}O_3$). This peculiar diastatic matter of Yoshida lost its power to oxidize urushic acid after being heated to 63°; so Yoshida thought it a substance of enzymatic nature, which acted as an oxygen carrier in these oxidations.

Some years later, Bertrand[6] studied the lacquer formation more carefully. He called the substance an oxidizing ferment, which he believed brought about the oxidation of the mother-substance of the black lacquer. He found that the ferment was destroyed by boiling, and also that it was present in gum arabic and gum senegal, as well as in the latex of species of *Rhus*. He named this ferment "laccase" and tested numerous plants for it, finding it present in many cases. Bertrand used the tincture of guaiacum as a test for laccase.

In 1895, Bertrand with Bourquelot[7] tested a great many of the higher fungi for laccase, using guaiacum as a reagent. They found that laccase was widely distributed in these plants as well as in those containing chlorophyll. They also investigated those fungi which become colored when injured, and they believed the phenomenon was caused by a ferment identical with laccase. Bertrand[8] has shown that the oxidizing power of laccase is in some way connected with the manganese present; for, by repeated precipitation with alcohol, he divided his laccase preparation into three

[6] Bertrand. (*a*) Sur la latex de l'arbre à laque. Compt. Rend. Acad. Sci. **118**: 1215. 1894. (*b*) Recherches sur le suc laiteux de l'arbre à laque du Tonkin. Bull. Soc. Chim. [3], **11**: 717. 1894.

[7] Bertrand and Bourquelot. Laccase dans les champignons. Compt. Rend. Soc. Biol. **47**: 579. 1895.

[8] Bertrand. Sur l'action oxydante des sels manganeux et sur la constitution chimique des oxydases. Compt. Rend. Acad. Sci. **124**: 1355. 1897.

fractions of different manganese contents, which with hydroquinone solutions showed activities proportional to their percentages of manganese. Bearing this in mind, other investigators have used mixtures of protein substances and manganese salts to prepare artificial oxidases giving many of the reactions of the natural preparations. It should be noted, however, that Bach and other investigators have prepared oxidases from various plants which, although active, did not contain manganese or iron.

During the last year, Euler and Bolin[9] have shown that the laccase prepared from alfalfa (*Medicago sativa*) is not an enzyme according to the commonly accepted usage of the word. They found that heating did not destroy the activity of the oxidase, and that the protein thus precipitated could be filtered off without lowering the activity in the least. This so-called laccase proved to be mostly calcium glycollate, with traces of the calcium salts of citric, malic, and mesoxalic acids.

If, as Bach and Chodat say, laccase consists of organic peroxides activated by the enzyme peroxidase, then it is the peroxidase part which confers upon laccase what specificity it has. However, laccase is not a specific enzyme in the narrow sense because, besides the laccol of *Rhus spp.*, it will oxidize guaiacol, hydroquinone, guaiac tincture, phenolphthalin, and many phenols and cyclic amino derivatives; still, it is not able to oxidize tyrosin or any of the tyrosin derivatives upon which tyrosinase exerts a truly specific action. So then, laccase is a specific enzyme, in that it acts only upon substances containing a certain grouping in their structure. The fact that laccase acts upon guaiac tincture and upon many other reagents usually employed to detect peroxidases, etc., makes one skeptical in regard to the nearly universal occurrence of laccase claimed for it by the earlier investigators.

Tyrosinase

After Bertrand and Bourquelot had shown that the bluing of *Boletus cyanescens* upon injury was due to the effect of laccase acting with the atmospheric oxygen upon the "boletol" in the

[9] *Loc. cit.*

fungus, they turned their attention to the case of *Russula spp.*, especially *R. nigricans*, the color change of which upon injury is from pink or reddish to black. In different researches they showed that laccase could not produce the same effect, and further, that it was an oxidation of a definite chemical substance in the fungus. Bertrand[10] next showed that the crystalline chromogen in *Russula spp.* was tyrosin and that it was also present in beets, potatoes, etc.; accordingly he named the enzyme which caused this change "tyrosinase," and said that laccase and tyrosinase were two representatives of the group of "oxidases." About this time it was found that rosettes of tyrosin crystals were present in the tissues of the fungus *Russula nigricans*.

At first it was thought that tyrosinase was as wide-spread an enzyme as laccase, but later results show this to be unlikely. Lehman and Sano[11] examined bacteria and higher plants for tyrosinase. A few species of bacteria showed the presence of tyrosinase, but in no case could it be separated from the living bacterial cells. Among the higher plants tyrosinase is present in wheat, barley, potatoes, *Papaver orientale*, *Rhus spp.*, etc. Thus we see, this enzyme is probably concerned in the formation of the black wound-covering over injured areas on potatoes.

The action of tyrosinase results in a yellowish pink coloration, then reddish, then brown, and finally black. This reddish black oxidation or condensation product is called melanin and is closely related to the natural animal pigments in dark hair, etc., and also in the so-called melanotic tumors. This action of tyrosinase and the resulting melanin have attracted a great deal of attention. The first investigators said that the action of the tyrosinase was simply the oxidation of tyrosin to melanin, and that the production of a black coloration in a plant was due to the action of its tyrosinase on tyrosin. However, it soon became clear that the matter was not so simple as at first thought. Certain experiments seem to show that the early change of tyrosin to a pink color

[10] Bertrand. Sur une nouvelle oxydase ou ferment soluble oxydant d'origine végétale. Compt. Rend. Acad. Sci. **122**: 1215. 1896. Also Bull. Soc. Chim. [3], **15**: 793. 1896.

[11] Lehman and Sano. Ueber das Vorkommen von Oxydations-fermenten bei Bakterien und höheren Pflanzen. Arch. f. Hyg. **67**: 99. 1908.

may be caused by an another enzyme and then it is upon this intermediate product that tyrosinase acts, finally giving the black melanin. The earlier workers considered that tyrosinase was a specific enzyme acting only on tyrosin, but in the course of time it has become evident that tyrosinase is specific in the same sense as laccase; namely, it acts upon a group of compounds closely related in structure.

Just as it is possible to obtain anti-toxins, research has shown that we may obtain anti-enzymes. In this place we are concerned only with the anti-oxidases, which have been produced in the usual manner, that is, by the repeated injection of small though increasing amounts of the enzyme preparation into a rabbit or other animal, and the withdrawal of some of the blood after immunity has been established to that particular enzyme. The blood serum from such immune animals prevents or retards the natural oxidizing action of the enzyme under investigation. Gessard[12] obtained anti-tyrosinase and anti-laccase that completely inhibited the oxidizing power of the corresponding plant enzyme preparations. We shall see later that anti-oxidases may play an important part in the physiology of the plant.

Generally speaking, tyrosinase seems to be the nearest to the true enzyme of any of the oxidases with which we are acquainted. It is most specific in its action, most sensitive to exterior conditions, and up to the present, has not been replaced by any artificial enzyme in the oxidation of tyrosin to a melanin. It is usually associated with laccase in plants, but the presence of laccase does not indicate the appearance of tyrosinase, while on the other hand, the latter is almost invariably accompanied by laccase.

As in the case of laccase, Bach[13] claims that the tyrosinase is really composed of two parts, oxygenase and the peroxidase. He found that by the use of alcohol precipitations he was able to reduce the activity of the tyrosinase of the potato, as previ-

[12] Gessard. (*a*) Anti-laccase. Compt. Rend. Soc. Biol. **139**: 644. 1904. (*b*) Sur la tyrosinase. Ann. Inst. Pasteur **15**: 593. 1901.

[13] Bach. Ueber die Wirkungsweise der Tyrosinase. Ber. Chem. Gesell. **41**: 221. 1908.

ously noted by Bertrand; but curiously enough, the addition of hydrogen peroxide to the enzyme solution restored it to its usual activity. This and many similar experiments led Bach to believe that tyrosinase contains the oxygenase and peroxidase complements.[14] Our final conclusion must be then, that tyrosinase may have the usual oxidase complements (oxygenase plus peroxidase) and that its peroxidase may be specific just as the peroxidase of laccase is specific in its action upon substances having a certain constitution.

(*To be continued*)

Laboratory of Biological Chemistry, of Columbia University,
College of Physicians and Surgeons, New York.

REDISCOVERY OF TILLANDSIA SWARTZII BAKER

By N. L. Britton

In "Journal of Botany," **26**: 12, published in 1888, and in "Handbook of Bromeliaceae," 191, 1889, Mr. J. G. Baker described this species, based on a specimen collected many years ago by Swartz in the island of Jamaica and supposed by him to be *Tillandsia paniculata* L. Professor Carl Mez, in his Monograph of the family Bromeliaceae (DC. Mon. Phan. **9**: 884), published in 1896, states that he has seen this specimen, but regards it as doubtful, perhaps referable to the Liliaceae.

The type specimen is preserved in the herbarium of the British Museum of Natural History, and while there in the spring of 1910, I examined it and was inclined to agree with Professor Mez. But, on returning to New York immediately afterward, I found in a parcel of choice Jamaica plants collected early the same year by Mr. William Harris, fine specimens, which I recognized as of the same species, and on sending one of these to Mr. Edmund Baker at the British Museum, he confirmed my identification by a comparison with the type. Mr. Harris found the plant growing on rocks in the Rio Minho Valley, March 3, 1910 (*No. 10,885*), more than one hundred years after its collection in

[14] Recently he found that the salts of manganese, etc., could apparently replace the peroxidase part. In this connection see: Ber. Chem. Gesell. **43**: 366. 1910.

FIG. 1. *Tillandsia Swartzii* Baker.

Jamaica by Swartz, and, presumably, it has not been seen in a living state by any botanist during this long period, a striking illustration of the extremely local distribution of some West Indian species.

It would appear that the plant was correctly referred to the Bromeliaceae at its original description; as Mr. Baker remarks, it is allied, at least in habit, to *Tillandsia utriculata* L., though he places the two in different subgenera. In floral structure it differs from both his subgenera *Platystachys* and *Cyathophora* by having a pair of scales at the base of each corolla-segment, and in this feature agrees with his subgenus *Vriesia*, a group regarded by Professor Mez as of generic rank.

As shown by the specimens collected by Mr. Harris, the inflorescence is about 1.3 meters high, floriferous from about the middle, the lower panicle-branches up to 3 dm. long, the lower bracts of the scape lanceolate, 1–1.5 dm. long, long-acuminate; the basal leaves are narrowly lanceolate, 6–8 dm. long, 4–6 cm. wide and very long-acuminate, glabrous and finely many-nerved; the flowers are sessile and quite widely separated on the slender branches of the inflorescence, their bracts ovate-lanceolate, acutish, about 1 cm. long; the linear sepals are 2 cm. long, and the thin parallel-veined petals 3 cm. long, linear-lanceolate and acuminate, about one-fourth longer than the stamens.

The capsule was described by Mr. J. G. Baker as at least twice as long as the calyx.

New York Botanical Garden.

LOCAL FLORA NOTES—VIII*

By Norman Taylor

Species	*Specimens wanted from*
	Cruciferae
Arabis hirsuta (L.) Scop.	Northern N. J. and N. Y.
Cardamine pratensis L.	N. J. or elsewhere in the range.†

* Continued from Bull. Torrey Club **37**: 559–562. N 1910.

† The local flora range as prescribed by the Club's Preliminary Catalogue of 1888 is as follows: All of the state of Connecticut; Long Island; in New York the

Species	*Specimens wanted from*
Cardamine rotundifolia Michx.	Western N. J. and eastern Pa.
Cardamine purpurea (Torr.) Britton.	Northern N. Y. and Pa.
Dentaria maxima Nutt.	Northern N. Y., N. J., and Pa.
Dentaria anomala Eames.	Anywhere in the range.
Dentaria diphylla Michx.	N. J.
Dentaria incisifolia Eames.	Anywhere in the range.
Dentaria heterophylla Nutt.	N. J.
Draba caroliniana Walt.	Anywhere in the range.
Lepidium apetalum Willd.	Anywhere in the range.
Lepidium medium L.	N. Y. and N. J.
Lepidium graminifolium L.	Anywhere in the range.
Roripa americana (A. Gray) Britton.	Northern N. Y. and Pa.
Roripa hispida (Desv.) Britton.	N. Y. and Pa.
Lunaria annua L.	Anywhere in the range.
Arabis patens Sullivant.	Eastern Pa.
Brassica japonica Siebold.	Anywhere in the range.

Sarraceniaceae

Sarracenia purpurea L.	Westchester, Orange, and Rockland counties, N. Y., and from Somerset Co., N. J.

Droseraceae

Drosera filiformis Raf.	Middlesex, Mercer, and Camden counties, N. J.

Podostemonaceae

Podostemon Ceratophyllum Michx.	Anywhere in the range.

counties bordering the Hudson River up to and including Columbia and Greene, also Sullivan and Delaware counties; all of New Jersey; and Pike, Wayne, Monroe, Lackawanna, Luzerne, Northampton, Lehigh, Carbon, Bucks, Berks, Schuylkill. Montgomery, Philadelphia, Delaware and Chester counties in Pennsylvania.

Species	*Specimens wanted from*
	CRASSULACEAE
Tillaea aquatica L.	Anywhere in the range.
Sempervivum tectorum L.	N. J. and N. Y.
Rhodiola rosea L. (Sedum).	Any stations not in Britton's Manual.
Sedum ternatum Michx.	Anywhere in the range.
	PARNASSIACEAE
Parnassia caroliniana Michx.	Anywhere in the coastal plain.
	SAXIFRAGACEAE
Micranthes (Saxifraga) micranthidifolia (Haw.) Small.	Eastern Pa.
Micranthes (Saxifraga) pennsylvanica (L.) Haw.	Northern N. J.
Tiarella cordifolia L.	Eastern Pa.
Heuchera Curtisii T. & G.	Anywhere in the range.
Heuchera pubescens Pursh.	Mountains of Pa.
Mitella nuda L.	Northern N. Y.
Chrysosplenium americanum Schwein.	L. I., central N. J., and Pa.
	HYDRANGEACEAE
Hydrangea arborescens L.	New Jersey.
	ITEACEAE
Itea virginica L.	Ocean and Monmouth counties, N. J.
	HAMAMELIDACEAE
Hamamelis virginiana L.	In or near the pine-barrens of N. J. and L. I.
	ALTINGIACEAE
Liquidambar Styraciflua L.	In or north of the highlands of the Hudson.

Species	*Specimens wanted from*
GROSSULARIACEAE	
Ribes lacustre (Pers.) Poir.	Northern N. Y.
Ribes glandulosum Grauer. (*R. prostratum* L'Her.)*	Pa. & N. Y.
Ribes americanum Mill. (*R. floridum* L'Her.)	Northern N. Y. and N. J.
Ribes triste Pall. (*R. rubrum* L.)	N. J. and N. Y.
Grossularia hirtella (Michx.) Spach. (*R. huronense* Rydb.)	N. J. and Pa.
Grossularia (*Ribes*) *Cynosbati* (L.) Mill.	Northern N. J., N. Y., and Pa.
PLATANACEAE	
Platanus occidentalis L.	Ulster, Greene, and Delaware counties, N. Y.

NEW YORK BOTANICAL GARDEN.

REVIEWS

The Plant Life of Maryland†

There are very few states in the Union whose vegetation has been described with any pretense of thoroughness, and in Maryland not even a catalogue of the vascular plants of the whole state had been published before; probably chiefly because the state contains very few rare and perhaps no endemic species, and therefore offers little attraction to the average systematic botanist. Maryland is the northernmost state, south of the glaciated region, which extends all the way from the coast to the mountains (and incidentally probably the only one which contains both *Taxus minor* and *Taxodium*, or *Pinus Taeda* and

* The names used are those maintained in North American Flora **22**: 193–209. 1908. The ones in brackets are those in Britton's manual.

† The Plant Life of Maryland. By Forrest Shreve, M. A. Chrysler, Frederick H. Blodgett and F. W. Besley. Special publication Maryland Weather Service, new series, Vol. 3, 533 pp., 39 plates (including 1 map), 15 text-figures (including 12 maps). Baltimore, 1910.

Abstracts or reviews of it have already appeared in Science II. **32** : 837–868. Dec. 16, 1910 ; Forestry Quarterly **8** : 484–486. 1911 ; and Scottish Geographical Magazine **27** : 1–6. *f. 1–4*. Jan., 1911.

Larix). Although comparatively small in area, it includes parts of such distinct physiographic provinces as the coastal plain, the Piedmont region, and the Alleghany mountains, the last reaching altitudes within the state of over 3000 feet; and the present work throws much light on the local distribution of the plants characteristic of each of these areas, or of two or more of them, and is an important contribution to existing knowledge of the vegetation of eastern North America.

After being delayed considerably beyond the expected time of appearance, as is very often the case with important scientific works, this handsome royal octavo volume, embodying the results of field work which was done mostly in the years 1904–6, was finally given to the public about the middle of last summer, the exact date not being known.

In mechanical make-up the book is fully up to the standard of other recent scientific publications of the state of Maryland, which means that it is practically faultless. The type is large and neat, and the 74 half-tone illustrations of vegetation are well chosen and skillfully executed in nearly every case, the principal exception being that one or two of them are a few degrees out of plumb.*

The principal author and one of the others having been absent from the state and largely engrossed with other matters during the printing, it fell to the lot of Mr. E. W. Berry as editor to bring the several contributions into harmony with each other as far as possible, and to attend to numerous other essential details; a kind of work which can hardly be appreciated by the reader, as it attracts attention only when poorly done.†

Besides the preface, indexes, and other necessary appendages, the book is divided into Part 1, Introduction, 42 pages; Part 2,

* This is a defect often observed in the best magazines, both popular and scientific, and even in text-books; but there would seem to be little excuse for it, as it lies within the power of author, editor, and engraver, each and severally, to remedy it before it is too late.

† The reviewer notes with gratification the editor's independence of an autocratic band of geographical orthographers located about forty miles from him, in spelling the names of the three counties which have possessive endings according to local and official usage, and not according to arbitrary rules.

Floristic plant geography, 30 pages; Part 3, Ecological plant geography, 192 pages; Part 4, Relation of natural vegetation to crops, 9 pages; Part 5, Agricultural features, 53 pages; Part 6, Forests and their products, 17 pages; and Part 7, List of plants, 114 pages. In all of these parts a three-fold division of the state on physiographic grounds (and not climatic, as one might be led to expect from the auspices under which the book appeared) into coastal zone (coastal plain), midland zone (metamorphic or crystalline rocks), and mountain zone (Alleghany plateau) is recognized. The coastal zone is further subdivided by Chesapeake Bay into two perceptibly different parts, and the midland zone into lower and upper (or foot-hills and ridges), corresponding with the Piedmont region and Blue Ridge of the states farther south.

Part 1, by Dr. Shreve, outlines the scope of the work, making a sharp distinction between floristic and ecological plant geography (a point which deserves more attention than has been given to it in the past), and then discusses the climatology, topography, mineralogy, and soils of the state.

Part 2, also by Dr. Shreve, opens with a brief sketch of the history of botanical exploration in Maryland, up to the time when the present authors took the field. Then follow lists of plants which are supposed to be confined to a single zone or to two adjacent zones, plants which reach their northern limits on or near the Delaware peninsula, strand plants, salt-marsh plants, pine-barren plants which seem to skip Maryland, etc. If the systematic list (part 7) represents fully the authors' knowledge of the local distribution of plants within the state, then some of the zonal lists might have been considerably modified or extended. But discrepancies of this kind are almost inevitable in such a large book, in which considerable time must elapse between the writing of the various parts. Kearney's table of the northern limits of "austroriparian" plants, although mentioned approvingly in a footnote on page 93, was apparently not utilized to the utmost in preparing the list of plants whose northern limits pass through Maryland. The list of "pine-barren" plants which are not known between New Jersey and

Virginia is somewhat misleading in that it includes at least half a dozen species which in the southern states are known only in the mountains, and not in the coastal plain, and one or two whose occurrence northeast of Maryland is doubtful. (It is interesting to note that nearly half of the 44 spermatophytes listed as pine-barren plants are monocotyledons, and the proportion would be still larger if the corrections just indicated had been made.) This part closes with an instructive discussion of the factors by which vegetation provinces are differentiated, and a bibliography of works relating to the flora of Maryland and the District of Columbia.

In Part 3, the longest and most important of all, the vegetation of each of the five subdivisions of the state is classified by habitat; Dr. Shreve taking the easternmost, middle and westernmost, Dr. Chrysler the "Western Shore" (that part of the coastal plain west of the Bay), and Dr. Blodgett the upper midland zone.

In the habitat lists prepared by Dr. Shreve, the species, instead of being arranged in taxonomic, alphabetical, or merely haphazard order, as was customary up to four or five years ago (and is yet, to a considerable extent), are divided into trees, shrubs, and herbs (bryophytes and thallophytes being left out of consideration), and arranged in approximate order of abundance (as stated in a rather inconspicuous way in a footnote on page 110). Unfortunately in such lists the trees are mentioned only by their common names, and these are run into paragraphs instead of being arranged in columns like those of the herbs, which makes this part less valuable for purposes of reference than it should be. In order to find from the index all that is said in the book about any particular species of tree its common name has to be constantly borne in mind. The names of the herbs are sometimes run into paragraphs too, but in most cases they are arranged in single columns, thus wasting considerable space which might easily have been filled with condensed information about the structure and adaptations, or even the geographical distribution, of each species. If smaller and more closely set type or double columns had been used for the herbs each habitat list would have been confined to one or two pages, and thus

more easily comprehended at a single glance. These details however were probably not left entirely to the judgment of the authors.

In Dr. Chrysler's part some definite ratios of abundance are given for the trees in certain habitats, but the herbs in most of his lists seem to be arranged in Engler & Prantl sequence, with no indication of relative abundance. Dr. Blodgett had to deal with a rather complex region, in which he found it expedient to describe almost every ridge and valley separately, and to mix trees, shrubs, and herbs together in his habitat lists, as if in the same order in which they were observed in the short time available for field work in that region.

The chapter on agricultural features (Part 5), by Dr. Blodgett, although it seems a little out of place in a volume devoted primarily to phytogeography, is a valuable original contribution to economic geography. After the history of settlement and agricultural development of the state there follows a discussion of the influence of soils on civilization, and then notes on the distribution of several of the principal crops, illustrated by maps.

Mr. Besley's remarks on forests (Part 6) are rather brief, but it would be hard to cover the ground any better than he did with the same number of words, and the forest industries of Maryland are probably not important enough at the present time to justify a more exhaustive treatment.

In preparing the list of plants collected and observed, Dr. Shreve did not waste any time ransacking old herbaria with a view of citing every specimen ever collected in Maryland, but included only plants which had been seen by him or his associates or by local botanists still living in the state. The list therefore makes no claim to completeness, but is primarily a taxonomic index to the plants which are classified by habitat in Part 3.

The nomenclature follows Britton & Brown's Illustrated Flora (1896–1898), and all specific names are decapitalized, as has been customary in Washington since 1893, but not so much elsewhere. Numerous arbitrary "common" names which are never seen outside of botanical literature have been inserted in the catalogue, but this practice is not carried to the extreme that it

was in some quarters a decade or two ago, for many of the less familiar species are left without such names. Ranges and bibliographic citations or other references to literature are omitted, which is entirely justifiable in such an unpretentious catalogue and in a region so well covered by descriptive manuals.

The information given about the distribution of the several species within the state is not as complete as an interested reader might wish, only about two lines (besides the name) being devoted to each, on the average, and usually not more than one county being mentioned. For over one-fourth of the species the catalogue gives no indication whatever of habitat, and a still larger number are treated in very general terms, like "swamps," "dry open situations," etc., which are not readily correlated with the habitats described in detail in Part 3. It would not be fair, however, to compare such a list with those numerous local floras in which a taxonomic catalogue is the most important feature.

Throughout the catalogue, as well as in other parts of the book, weeds are not distinguished very sharply from native plants, which is unfortunate, though not at all unusual. Weeds are more easily recognized than some persons who have not given the matter much thought may imagine, and a reform in this respect is urgently needed in all our phytogeographical literature.

An extremely conservative course has been followed with regard to the numerous recently described (and perhaps ill-defined?) species of *Panicum*, *Sisyrinchium*, *Rubus*, *Crataegus*, *Viola*, etc., the five genera just named having only 56 species among them in the book.

The catalogue comprises 60 pteridophytes, 13 gymnosperms, 384 monocotyledons, and 980 dicotyledons, or 1437 species and varieties of vascular plants. About 28.2 per cent. of the angiosperms (counting both native and introduced species, for they are not separated) are monocotyledons, which seems to show that the vegetation of Maryland is on the whole considerably nearer the climax condition that that of New Jersey, and farther from it than that of Pennsylvania.

In the general index the only persons mentioned are those whose names occur on the first 20 pages. About 75 others, many of whom are shown in the text to have made important contributions to the knowledge of the Maryland flora, are omitted. This perhaps should not be charged up to the authors, however. The botanical index seems to be complete, except for the plants mentioned on pages 86, 87, and 385 (and these are the ones excluded from the state flora), and in the footnotes on page 164 and in the catalogue.*

With the few exceptions here noted, the Plant Life of Maryland is a model of its kind, and it easily ranks among the foremost of existing local phytogeographical works. It is to be hoped that botanists in other states, especially those whose vegetation has not yet been systematically described, will soon follow the splendid example set by Dr. Shreve and his associates.

Roland M. Harper.

Apgar's Ornamental Shrubs of the United States

In criticising a book we must look at it from the standpoint of the author. The late Mr. Apgar has fully informed us in the preface that his aim has been to produce a work that will reach "that large public who wish to know by name the attractive shrubs cultivated in parks and private grounds, but who are actually afraid of anything called botany." Viewed from this frank avowal of its purpose, the little book before us will fill the need of a large number of people who have not an extended knowledge of botany and its terms. What terms the author has found it necessary to use have been fully explained in the first part of the work and in the glossary at the end. The primary classification is based upon the form and position of the leaves, when these are present; or in their absence keys are provided for deciduous-leaved shrubs, and for thorny or spiny

*Although the present work is not a good illustration of the point, it might not be out of place to remark here that indexing is too often regarded as a mere mechanical process, requiring no intelligence or discretion, and delegated by the author to persons who have no interest in his work.

†Apgar, A. C. Ornamental Shrubs of the United States (Hardy, Cultivated). Pp. 1–352. *pl. 1–4. f. 1–621.* American Book Co. Price $1.50.

plants. Flowers and fruits are assigned a secondary place. Part II is devoted to the "General Opening Key" and the "Keys to the Genera," with instructions as to their use. In Part III are the descriptions of the shrubs, and here a valuable help is offered in the numerous illustrations, made by the author himself, in which he has indicated what are considered the essential characters.

The little work must not be viewed from the scientific standpoint, for the author makes no claim along this line. Considered from the point of view of the author, and of that large class who desire merely to know the names of shrubs, this little volume will be of great use.

George V. Nash.

A recent investigation of the sargasso sea was undertaken by Dr. John J. Stevenson. He says (*Science*, December 9, 1910) that the "indefinite descriptions of the area and mass of seaweed, as well as the extraordinary statements made by some authors in discussing the origin of coal, induced the writer to make an examination of the conditions for himself. The matter is easy, because the steamship route between Barbadoes and the Azores crosses the area diagonally and passes very near the center." His own observations, and the information gained from officers who had crossed the sargasso sea many times, lead him to think that "much depends on the time of year, for weed appears to accumulate while the trades are mild and to be broken up later in the season when the strength of the winds increases. In any case, however, the weed occupies only a small part of the area, the patches being separated by wide spaces of clear water, almost free from weed. Many of the bunches show unmistakably that they had been attached to rock; and the plants have traveled far, since in a large proportion of bunches only a part is living, the dead parts being of a brownish color." It is evidently unusual to find a patch exceeding a half acre in extent. In passing through the Bahamas the seaweed is found to be "much more abundant than along either of the lines followed across the sargasso. The weed is evidently the same, being in circular bunches

up to 18 inches diameter arranged in strips according with the direction of the wind, though occasionally in bands or even in patches 8 by 10 feet. The patches are near the large islands."

Mr. Stevenson feels that "At best, the quantity of weed seen at any locality is wholly insignificant. Midway in the sargasso sea, the bunches seen in a width of a mile would form, if brought into contact, a strip not more than 65 feet wide. This, where the weed is most abundant. But the bunches are very loose, the plant material, as was estimated, occupying less than one fifth of the space, so that if the bunches were brought together so that the plant parts would be in contact, each square mile would yield a strip not more than 13 feet wide and 3 or 4 inches thick, or barely 2,500 cubic yards to the square mile. . . . The accumulation of decayed vegetable material from seaweeds must be comparatively unimportant under the sargasso sea; and what there is would be merely foreign matter in mineral deposits."

J. B.

PROCEEDINGS OF THE CLUB

November 30, 1910

This meeting was held at the New York Botanical Garden. Nineteen persons were present. Vice-president Barnhart occupied the chair.

The minutes of the meeting of November 8 were read and approved. Dr. W. D. Hoyt, of Rutgers College, New Brunswick, N. J., was proposed for membership.

The first paper of the announced scientific program was by Dr. N. L. Britton on the "Flora of Pinar del Rio, Cuba." Dr. Britton gave an account of his recent botanical explorations in this province of Cuba in company with Mrs. Britton, Professor F. S. Earle, and Professor C. Stuart Gager. After a sketch of the earlier botanical explorations of Cuba by Charles Wright and others, the general floral features of the province of Pinar del Rio were described and many specimens were exhibited. An account of this work is published in the *Journal of the New York Botanical Garden* for October.

The second paper on "Thistle Hybrids from the Rocky Mountains" was by Dr. P. A. Rydberg. The speaker exhibited specimens of nineteen supposed hybrids in the genus *Carduus*, together with their putative parents. The evidences of hybridity were drawn from intermediate morphological characters, supported in most cases by close association in nature with the supposed parents. Descriptions of these *Carduus* hybrids were published in the *Bulletin* for November.

Adjournment followed.

MARSHALL A. HOWE,
Secretary pro tem.

DECEMBER 13, 1910

The meeting was called to order at the American Museum of Natural History at 8:30 P.M. Tuesday, December 13, 1910, with President Rusby in the chair. One hundred people were present.

After the reading and approval of the minutes of November 30, 1910, Dr. W. D. Hoyt, Rutgers College, New Brunswick, N. J., and Miss Jessie P. Rose, Crystal, Oregon, were elected to membership.

The resignations of Prof. Henry Kraemer, Dr. Raymond H. Pond, and Mrs. L. Schöney were read and accepted.

The scientific program consisted of an illustrated lecture by Dr. Marshall A. Howe on "A Visit to the Panama Canal Zone."

The visit described by the speaker occurred in December, 1909, and January, 1910, and was undertaken under the auspices of the New York Botanical Garden, with the special object of studying and comparing the marine floras of the Atlantic and Pacific oceans, here within less than fifty miles of each other.

The marine algae proving unexpectedly scarce, especially on the Pacific side of the Isthmus, there was considerable opportunity for taking photographs of general botanical interest and the lantern-slides shown illustrated chiefly some of the more striking features of the land flora of the Canal Zone, such as the numerous native palms, the vegetation of the extensive fresh-water swamps between Colon and Gatun, the swampy forests bordering the

Chagres River, and the flora of the rocky islands of Panama Bay, A report covering some of these features of the lecture was published in the *Journal of the New York Botanical Garden* for February, 1910.

The speaker justified a somewhat extended discussion of the Panama Canal and its history by the general interest in the subject both here and on the Isthmus. Among the photographs shown were several of the Atlantic and Pacific entrances to the Canal, the Gatun locks, a flood on the Chagres River, the Culebra Cut, the Ancon Hospital, and the Taboga Sanitarium. The success of modern sanitary methods in combatting yellow fever and malaria was especially dwelt upon. The speaker alluded also to incidents of interest in the romantic early history of the Isthmus and in the building of the Panama Railroad. Photographs of the ruins of Old Panama, located about five miles east of the present city, were also shown.

Adjournment followed.

Sereno Stetson,
Secretary pro tem.

OF INTEREST TO TEACHERS*

College Botany Notes

An interesting set of sheets giving some of the directions for freshman and sophomore botany has been provided us by Professor Clements of the University of Minnesota. Drawings form quite a prominent part of the work as might be expected. It is directed that the drawings be drawn to scale—a thing which is more important than most of us realize. The following recommendation is also made: "As a rule, write the answers to the questions first, and make the drawings afterward." The procedure is often exactly the opposite, with the result that the drawing shows but indifferently the characteristics of the plant parts under consideration. Structure and function are too often too widely separated—in time at least—even in general courses in botany. In the work on plant cells and tissues given below

*Conducted by Miss Jean Broadhurst, Teachers College, Columbia University.

one can see clearly that very different drawings would be made before and after answering the questions.

1. Cell and protoplasm (Lat., cella, room: Gr., protos, first plasma form).

   (*a*) Mount a leaf of the water weed, *Philotria*. Note the structure of the cell, the position of the green bodies, chloroplasts, and especially the movement of the protoplasm. Compare various cells.

   (*b*) Mount a stamen of the spiderwort, *Tradescantia*, taking care not to crush it. Note the structure of the stamen-hair, and especially the streams of protoplasm and the nucleus.

   Answer the following questions definitely but briefly: (1) Explain the different shapes of the cells. (2) What indicates that the wall is elastic? (3) Do the streams of protoplasm change their shape, position, or direction? (4) What forms the "banks" of the streams? (5) Find the rate of flow. (6) Does the protoplasm pass from one cell to the next? (7) How and why does it line the cell wall? (8) Explain the position and shape of the nucleus. (9) Does the nucleus move? If it does, explain how. (10) Do the streams center at it? Do they flow into it or over it? (11) What fills the bulk of the cell? Draw to scale a cell of *Philotria*, showing the wall and chloroplasts; draw a cell of the stamen-hair, showing wall, streams of protoplasm, nucleus, etc.

Almost all of the work is carried on in the field and greenhouse. Lectures and books are replaced by independent laboratory (in the widest sense) work by the students. It means time, patience, and real teaching power on the part of the instructors if the students are to solve for themselves the problems of physiology and work out the structural adaptation to function. It is also felt at the University of Minnesota that the students are more interested by and in work of this type than by the usual method of lectures, and text and reference books.

The beneficial effects of soil bacteria have lately received much emphasis. The *Outlook* notes popularly the recent investigation of injurious soil bacteria—(October 29, 1910) at the experiment station at Rothamsted, England. "It occurred to the experimenters at Rothamsted that perhaps there exist similarly in the soil, not only the "good" microbes that can be reinforced at will, but "bad" organisms that, as in the human system, are at warfare with the benefactors. And this was demonstrated to be a fact. Perhaps, then, they thought, we can not only reinforce the helpful organisms by addition from without, but treat the soil with something that will kill or minimize the effect of those undesirable. Isolating the organisms and experimenting with them, it was soon found that various antiseptics, in liquid and in vapor form, will kill or paralyze the undesirable organisms, and hence, if applied to soils, materially increase their yield, even without a reinforcement of the army of their natural enemies, the ammonia-forming bacteria; and at length it was discovered that heat alone will answer every purpose. Partial sterilization of the soil by heat, while destroying some of the desirable bacteria, totally destroys those that prey upon them. Cans of earth from the same field heated to about the temperature of boiling water yield enormous growths of leaf and seed compared with identical samples unheated. Here is the sign-post that points to a most fascinating path of research. Perhaps some way will be found to apply this discovery practically. Experiment will not rest here, although it seems at first thought impossible to *heat* the soil over any large area; yet in greenhouses it might pay, where the area under cultivation is relatively small and the crop relatively very valuable. A lady of our acquaintance found it impossible to grow certain flowers in a pot; the seeds germinated, but the plants failed to mature. Thinking that there might be some worm or grub in the soil that attacked the seeds or the roots, and that heat might kill it, and as fresh soil was not easy to secure in the city, she put the pot in the oven and baked the contents. Afterwards there was no trouble when the seeds were again planted. She had unconsciously confirmed the Rothamsted experiment, destroying the harmful bacteria. Professor

Hall, the writer of the article which is the subject of this review, concludes as follows, after admitting the difficulty of applying this remedy on a large scale: "Sooner or later, our trials will reach a cheap and practical issue. But if we do succeed, we shall have added one more to the number of new discoveries which are as old as time: Virgil in his Georgies describes the advantages to be obtained by mixing the surface soil with weeds and rubbish and burning it gently, and the practice is still followed among the native cultivators in India." This, Mr. Hall concludes means a warfare "against an invisible population, of which the very existence was unsuspected a generation ago." And the results are due to the killing of "unsuspected groups of large organisms of the protozoan class, which feed upon living bacteria," and heating or treatment by antiseptics relieves the bacteria which partially escape the treatment from their attack, allowing them to increase to an enormous degree, with a corresponding rise in ammonia production—and therefore of fertility. —*Science*, September 16, 1909.

The October *Journal of the New York Botanical Garden* contains an article by George V. Nash on "Winter Decorative Shrubs." Over thirty such shrubs are listed with brief descriptions. School grounds are usually planted with summer decorative shrubs, and are consequently not at their best during the greater part of the school year. It is possible to use winter shrubs in such a way as to add to the summer display, and yet leave a well-balanced and pleasing scheme during the winter.

A recent paper by Alma G. Stokey on *Lycopodium pithyoides* notes the fact that in this species the sporangia are cauline rather than folia, through continued inequality in the rate of growth which causes it eventually to take a "position on the stem entirely distinct from the leaf."

The Japanese are going to replace the cherry trees presented to Mrs. Taft by Japan to adorn the Potomac Drive at Washington, and which had to be destroyed on arrival because they were infected by insects.

NEWS ITEMS

We learn from the *Ottawa Evening Journal* of January 19 details of the remarkable expedition of Mr. J. M. Macoun, naturalist of the Geological Survey of Canada. He left Halifax on July 2d, reached Churchill on the twenty-fifth and after botanizing for a month in that vicinity started north. Sailing up Hudson Bay, in the steamer "Jeannie" the party reached Wager Inlet, which is almost on the Artic Circle, and here on the evening of September 5th the vessel was wrecked in a storm. The party rigged up two small boats, rescued from the "Jeannie," and succeeded in reaching Fullerton, about 150 miles southward, in two and a half days. From Fullerton to Churchill it is 450 miles and they made this part of the return trip in a whaler. Finding it impossible to stop at Churchill on account of scarcity of food the party traveled 800 miles overland by snow shoes and sledges to Gimli in Manitoba, a small town on the southerly end of Lake Winnipeg. Here they were within reach of civilization. The botanical specimens were all saved and will prove of much interest as "before no botanist had been on the west coast of Hudson Bay between Churchill and Repulse Bay." At the latter place all the species are arctic. No lives were lost and no one was seriously injured.

The American Fern Society has elected the following officers for 1911: *President*, Philip Dowell; *Vice-president*, Miss Nellie Mirick; *Treasurer*, H. G. Rugg; and *Secretary*, L. S. Hopkins.

In honor of Prof. L. R. Jones, formerly of the University of Vermont, and now professor of plant pathology at the University of Wisconsin, a 450-acre reserve in Vermont has been named the "L. R. Jones State Forest."

During February and March several hundred orchids will be in flower at the New York Botanical Garden. The collection includes many interesting and rare species from all parts of the world.

The editor of TORREYA has accepted the position of Curator of Plants at the Brooklyn Botanic Garden, the appointment to take effect March 16, 1911.

TORREYA

March, 1911

Vol. 11 No. 3

THE CLOGGING OF DRAIN TILE BY ROOTS

By G. E. Stone

Quite frequently trouble is experienced from roots of various trees entering drain tile, sewers, etc., and this often causes much vexation, labor and expense. The Carolina poplar, which is often planted as a shade tree in cities, frequently becomes a nuisance in consequence of its peculiar habit of working its roots through the joints of tile used for sewerage, etc. It is a comparatively easy matter for roots to gain entrance into the uncemented joints of tile, and even when tile is cemented they often manage to crowd in and fill the tile with a mass of roots which eventually clog the tile and render it useless. Instances are even known of roots penetrating sewers constructed of brick and cement. The roots of other trees besides Carolina poplars are known to be offenders in this respect. Willows, elms and others are responsible for considerable clogging of tile, and grass roots will in a comparatively short time put out of commission the most effective drain. There are also many instances of even fungi and algae clogging up small drains. The writer some years ago had called to his attention a case of *Oscillatoria* constantly clogging tile, much to the annoyance of the landowner; and, is also familiar with a case where the drain tile underlying the steam conduit of a central heating and distributing plant was continually being clogged by root growth. The joints of the six-inch Akron tile underlying the steam heating pipes were not cemented and were four or five feet below the surface. In two or three years after the tile were laid some of them had become clogged with elm tree roots. This clogging prevented the water from flowing through the tile and caused a dam, as it were, resulting in the water flowing back into the conduit and flooding

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the steam pipes which greatly interfered with their efficiency. It is necessary, of course, to leave the joints of Akron tile open when used for the purpose of draining the conduit trench since these pipes must take off the water from the trench and prevent it from coming into contact with the steam pipes in the conduit. As long as the joints remain open it is with great difficulty that the roots of trees, etc., are kept from growing in the tile, and sooner or later it is made ineffective.

Tree roots will penetrate tile protected with carefully cemented joints and become a nuisance, as is shown by the following instance. In the city of Newark, N. J., the Shade Tree Commission have been requested by the Department of Sewers and Drainage to omit the planting of Carolina poplars on streets since the roots of these trees proved to be a nuisance to drains. Mr. Edward S. Rankin,* Engineer of Sewers and Drainage of the city of Newark, writes as follows:

"Replying to your letter of the twentieth inst., we find that the roots go through the joints of tile pipe even when carefully cemented and the trouble seems to be increasing. In 1909 we had 15 stoppages caused by roots; for the first 11 months of 1910, 23, of which 5 occurred in the month of November. These stoppages were all in house connections, and in addition to these we have also had a number of cases in our main pipe sewers. The roots after penetrating the pipe seem to spread out and practically fill the whole pipe. I have no way of knowing how long a time it takes for these roots to grow. To the best of my knowledge we have had no trouble with any of our brick sewers. The trouble seems to have been caused in all cases by poplar trees."

There recently came to our attention a notable case of a large drain tile being clogged by the roots of a pear tree. This tile was 12 inches in diameter and was laid about seven years ago to take the seepage waters from a reservoir located in the town of Belmont, Mass. The pipe passed near a pear orchard, and there was a constant flow of water through it summer and winter, although it was never full. At the time the tile was laid the joints were not cemented, and of course there was an opportunity

*See also Municipal Journal and Engineer, vol. 30, no. 1, January 4, 1911.

for roots of various kinds, if so disposed, to penetrate the joints of the pipe and secure an abundant supply of water. During November, 1909, about seven years after the drain pipe was installed, it became necessary to dig up a large part of it on account of its inefficiency and replace it. It was found on digging up this tile that it was badly congested by a profuse root growth. A careful examination of the location showed that this growth

FIG. 1.—Showing pear tree root taken from drain tile.

of roots originated from a single off-shoot of a pear tree located some seven feet away. This enormous mass of pear roots was removed from the tile and carefully laid aside and at our request was presented to our museum, with full data concerning it. The roots were found to measure 61 feet in length. Only a single root entered the tile, it having a diameter of about five-eighths of an inch inside the tile, but where it entered the tile it was somewhat flattened out. The root, on entering the tile, subdivided into innumerable rootlets, and these were again divided into countless smaller roots. At the time the tile was

dug up and the roots removed the drain had been in operation seven years, although a cross-section of the root and an examination of the annular rings where it entered the tile, showed that it was only five years old. It required, therefore, only five years for this mass of roots to clog up a 12-inch tile.

The maximum diameter of this mass of roots in the dry state is six or seven inches, but when alive and flourishing in the tile its diameter exceeded this. The roots as they reached the laboratory had a decidedly bad odor, showing that if no sewage was present in the tile there was certainly a considerable amount of organic matter in the seepage derived from the soil or some other source which proved of value as plant food. Soon after the specimens arrived at this laboratory they were spread out on the floor and measured. This was done by laying out on the floor sections five feet in length. The number of roots in each five-foot section was counted. These were multiplied by the length of the section and the whole tabulated (see table). The total length of these roots was 8,498 feet, as shown in the table, which is equal to 1.61 miles. Adding to this the numerous small roots which range from a few to several inches in length and which were not considered in our section count, the total length was estimated to be over two miles.

This enormous development from a single root of a pear tree is greatly in excess of what would take place if the roots were

Table Showing the Growth of Pear Tree Roots in Drain Tile

No. of Section.	Length of Section.	No. of Roots in Section.	Length of Roots in Section.
1	5 ft.	34	170 ft.
2	5	41	205
3	5	73	365
4	5	153	765
5	5	199	995
6	5	313	1565
7	5	373	1865
8	5	447	2235
9	5	141	705
10	5	53	265
11	5	31	155
12	5	36	180
13	1	28	28
Total	61	1922	8498

in the soil, since the conditions of the drain tile stimulate root development very materially. However, the root system of any tree or shrub is far in excess in length and area of what the layman imagines. The profuse growth of roots in water is also seen in cases where old wells become filled with root growth, but the pear tree root in question is one of the best examples which has ever come to our notice of root development in drain tile.

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THE NATURE AND FUNCTION OF THE PLANT OXIDASES

By Ernest D. Clark

(*Continued from February Torreya*)

Peroxidase

Besides the laccase and tyrosinase which we have been considering, there are other oxidizing enzymes which are not specific like the two mentioned. They act only in the presence of hydrogen peroxide, and therefore are called peroxidases. These enzymes have also been called "indirect oxidases" in distinction from those substances (Bach's oxygenases) which show their activity without the addition of peroxide as in the case of tyrosinase, etc. In 1903, Bach and Chodat[15] discovered that by fractional precipitation of aqueous extracts of *Lactarius vellereus*, they were able to obtain two precipitates of very different properties. The fraction insoluble in 40 per cent. alcohol proved to be a direct oxidase, while the other fraction, soluble in 40 per cent. alcohol, but insoluble in 95 per cent. alcohol, had no direct oxidizing properties. With hydrogen peroxide and other peroxides, however, the second fraction showed strikingly peroxidase properties. Moreover, the peroxidase fraction, when allowed to act with the direct oxidase fraction, showed all the properties of

[15] Bach and Chodat. Title of series is: Untersuchungen über die Rolle der Peroxyde in der Chemie der lebenden Zellen; V. Zerlegung der sogenannte Oxydasen in Oxygenasen und Peroxydasen. Ber. Chem. Gesell. **36**: 606. 1903.

the original oxidizing substance as present in the plant. This research was the beginning of a series of notable contributions to our knowledge of the oxidizing enzymes. In another paper, these authors state that peroxidase is present in nearly every plant. They were able to prepare a pure peroxidase from the horse-radish root, which exhibited great stability towards heat. In further comparative studies they showed that peroxidase great y augments the power of the natural oxidases, especially that oxygenase from the same source as the peroxidase itself. All of these observations led Bach and Chodat to separate oxidases into two parts, the organic peroxide part, which they called "oxygenase" and the activator of oxygenase and other peroxides, to which alone they gave the name "peroxidase."

Kastle and Loevenhart[16] in 1901 published a very important paper which has not always received due attention from the European chemists engaged in this work. These authors found that the substance bluing guaiacum directly is easily precipitated by alcohol and is destroyed by small amounts of hydrocyanic acid, hydroxyl amine and phenyl hydrazine. It seemed peculiar to them that these substances should be so harmful, but that sodium hyposulphite, silver nitrate and mercuric chloride, substances usually fatal to enzymes, should exert little effect on the constituent of the potato which blues guaiacum directly. In general, those substances which prevented the direct bluing of guaiac tincture by the potato juice also prevented similar action upon guaiacum by the organic and inorganic peroxides with which they experimented. All of these experiments caused them to believe that this direct bluing was not due to enzymes at all, but to organic peroxides which were formed when the juice is exposed to the air, according to Engler's theories of auto-oxidation. Thus we see, the idea that oxidases are made up of an organic peroxide part activated by the enzyme peroxidase receives further confirmation from this work of Kastle and Loevenhart.

In a valuable paper by Kastle[17] on "The Stability of the

[16] Kastle and Loevenhart. On the Nature of Certain Oxidizing Ferments. Amer. Chem. Jour. **26**: 539. 1901.

[17] Kastle. On the Stability of the Oxidases, etc. Bull. 26, Hyg. Lab. U. S. Pub. Health and Mar. Hosp. Serv. Washington, 1906.

Oxidases," it appears that oxygenases of certain fungi are extremely resistant to the influence of both heat and long standing. In the case of the oxygenase from *Lepiota americana*, it was necessary to heat for several minutes to a temperature of about 85° in order to destroy the power of the extract to blue guaiacum directly. Still more striking is the case of the glycerin extracts of certain *Lactarius spp.*, which after standing from 1905 to 1909 were found to be still active towards both guaiacum and tyrosin. It is interesting to note that of the many species of the higher fungi which Kastle tested, only one, *Amanita verna*, did not show any response for the oxidases. This p'ant is so poisonous that it has been called the "destroying angel."

From all the experimental work of the different investigators it seems probable that peroxidase is an enzyme rather than a simple catalyzer. Little is really known of the nature of peroxidase. Bach[18] has prepared a powerful peroxidase which gave no tests for proteins, nor did it contain iron or manganese. On the other hand, Van der Haar[19] claims his *Hedera* oxidase was a glucoprotein. Resistance to heat seems to be a peculiarity of peroxidase. Heating to boiiing is necessary to destroy peroxidase, while oxygenase is destroyed at a much lower temperature. Bach and Chodat noted this fact and also that upon standing after boiling, the peroxidase regained its activity. Woods[20] first discovered this phenomenon while studying the peroxidase of the tobacco leaf, and concluded that in these cases we are dealing with a zymogen or a substance which regenerates the peroxidase upon standing. Aso[21] also found that there were zymogens more stable towards heat than peroxidase itself, which slowly yielded more of the latter after the destruction of the initial supply. A second heating permanently destroys the peroxidase; the stronger the solution of the enzyme, the more resistant it is towards heat.

[18] Bach. Zur Theorie der Oxydasenwirkung: I. Mangan und eisenfreie Oxydasen. Ber. Chem. Gesell. **43**: 364. 1910.

[19] Van der Haar. Untersuchungen in Pflanzenoxydasen: II. Die Hederaperoxydase, ein Glucoproteide. Ber. Chem. Gesell. **43**: 1321. 1910.

[20] Woods. The Mosaic Disease of Tobacco. Report No. 18 [p. 17], U. S. Dept. Agric. 1902.

[21] Aso. Which Compound Can Liberate Iodine from Potassium Iodide? Beihefte z. Botan. Centralblt. **15**: 208. 1903.

The writer has also noted cases of the regeneration of the peroxidase after its apparent destruction by heat, especially in the case of the oxidase of the sweet-potato. Hasselbring and Alsberg[22] have recently found that only in the presence of coagulable protein are the oxidases easily destroyed by heat.

With the exception of catalase there is probably no enzyme more common among plants and animals than peroxidase. There is hardly a plant or any part of its organs that does not blue tincture of guaiacum in the presence of hydrogen peroxide, thus proving the presence of peroxidases. The oxidases also play an important part in many industrial processes. The curing of tobacco, the production of the bouquet of wines, and the formation of commercial indigo from *Indigofera anil* in India, all seem to be somewhat dependent upon the oxidases. Green tea is produced when the freshly picked leaves are immediately spread on hot plates which, of course, destroys the oxidases, while the slow curing with consequent activity of the oxidases yields the black tea of commerce. The aroma of the vanilla-bean and the fragrance of the English meadow-sweet (*Ulmaria Ulmaria*) have also been attributed to oxidase action. Leptomin is really a peroxidase but Raciborski,[23] finding the indirect oxidase localized in the leptome (phloem) of plants, considered it a new enzyme, and one distinct from the direct oxidase. With guaiacum and hydrogen peroxide the strongest bluing is localized in the phloem through which the sieve-tubes pass, the latter acting as carriers of the food materials of the plant. This so-called leptomin is present in largest amount in the phloem of the latex plants. These illustrations will serve to show the distribution and importance of the oxidases in plants.

Catalase

It has long been known that finely divided metals, blood, plant juices and fluids from the animal body cause the rapid decomposition of hydrogen peroxide. But this fact did not

[22] Hasselbring and Alsberg. Studies upon Oxidases [an abstract]. Science II. **31**: 637. 1910.

[23] Raciborski. Ein Inhalts-korper des Leptoms. Ber. Botan. Gesell. **16**: 52. 1898.

attract special attention at first because it was generally thought that the power to decompose hydrogen peroxide was a property common to all ferments (enzymes). However, beginning in 1888 with Bergengrün, different investigators discovered that the power to decompose hydrogen peroxide into oxygen and water could exist independently of the ordinary activities of such enzymes as the oxidases, diastase, emulsin, etc. Gottstein stated that the power of cells to break up hydrogen peroxide is due to their nucleic acid content and not to any enzyme, and furthermore, this power is shown after the death of the cell as well as during life. In 1901, Loew[24] found, in his studies on the enzymes of the tobacco leaf, that these leaves often caused a very active evolution of gas from hydrogen peroxide, but yielded none of the tests for oxidases, protein digesting enzymes, and other enzymes. This led him to study the matter more fully, with the result that by precipitation of the leaf extracts with ammonium sulphate and subsequent purification by alcohol precipitation, he obtained preparations that were extremely active in decomposing hydrogen peroxide, but which had no other property agreeing with the other classes of enzymes, such as the starch digesting action of diastase, etc. He named this substance "catalase" and considered that it was a new enzyme. Loew then made a more careful study of catalase and found that it apparently existed in two forms, α-catalase, which is insoluble in water, and the β-catalase, soluble in water. In a study of its distribution, Loew found that catalase is of practically universal occurrence in both plants and animals, a conclusion fully substantiated by the work of all later investigators. Recent observations made by Appleman[25] seem to show that catalase may be separated into a water-soluble and -insoluble portion as was previously claimed by Loew.

Euler[26] investigated the catalase of the fungus *Boletus scaber* in a painstaking manner. This catalase proved to be more sensitive to acids than animal preparations, but like them, there seemed to be some connection between the fat content of the

[24] Loew. Catalase, a New Enzyme of General Occurrence. Report No. 68, U. S. Dept. Agric. 1901.

[25] Appleman. Some Observations on Catalase. Bot. Gazette **50**: 182. 1910.

[26] Euler. Zur Kenntniss der Katalase. Hofmeister's Beitrage, **7**: 1. 1908.

fungi and the amount of their catalase. Like the other investigators, he found that in dilute solutions and with a relative excess of the enzyme solution, the reaction followed the equation for reactions of the first order, thus tending to show that active oxygen was formed. In some cases he found that the physico-chemical constant k' equalled 0.0107 at 15°, this value for k' being identical with that found by Bredig and his collaborators for a colloidal platinum solution containing 0.006 gram of the metal per liter. The enzyme solution used by Euler in this determination contained 0.004 gram of enzyme preparation per liter. This enzyme was associated with globulin, but, taking the molecular weight as 1000, while that of platinum is 195, then 0.006/195 N equals the concentration of platinum and 0.004/1000 N equals the concentration of enzyme. This will give one an approximate idea of the tremendous catalytic activity of both of these substances. Not only do colloidal metal solutions and the vegetable catalases act in the same quantitative manner, but they also show the same sensitiveness to chemicals.

It seems likely that there is an antagonistic action between peroxidase and catalase. Shaffer[27] found that if uric acid were allowed to stand for several days with hydrogen peroxide solution, it was oxidized, but in the presence of catalase and hydrogen peroxide, there was no oxidation of the uric acid. This led Shaffer to believe that the spontaneous decomposition of the hydrogen peroxide results in the formation of traces of active oxygen, while that set free under the influence of catalase is wholly in the molecular (inactive) state. The main point of Shaffer's publication is that the oxygen set free by catalase is not in a nascent state and therefore catalase may have a certain protective power in the oxidation processes carried on by the cell. Herliztka[28] agreed with Shaffer that catalase has a protective action in the presence of peroxides or peroxidases. He also made quantitative studies on the oxidation of guaiacum by peroxidase and found a retarding action in the oxidation whenever catalase

[27] Shaffer. Some Observations on the Enzyme Catalase. Am. Jour. Physiol. **14**: 299. 1905.

[28] Herliztka. Richerche sulla catalasi; Sull'antagonismo tra catalasi e perossidasi. Rendic. Accad. Lincei. Atti. V. **16**^{2}: 493. 1906.

was present. Bach showed that in a mixture of catalase and peroxidase the latter did not have an appreciable effect upon the action of the catalase. As we shall see in discussing the rôle of catalase in the cell, it is possible that it acts as a brake on the processes carried on by the oxidases.

In the catalytic decomposition of hydrogen peroxide into water and oxygen there has long been a controversy in regard to the nature of the oxygen evolved; that is, whether it is in the active state or in the inactive molecular condition. Now, in the case of catalase we know from the results of Shaffer and others, that no active oxygen is formed in the process, because guaiacum is not blued, and none of the reactions of nascent oxygen are shown; and furthermore, as Shaffer pointed out, if catalase produced active oxygen in the living cell, the protoplasm would probably be killed at once by this extremely active and destructive agent. How are we to harmonize those of the physico-chemical measurements with the results of Shaffer, Liebermann and others? From the physico-chemical data, the oxygen is in an atomic state, while from tests on the reaction mixture, it is apparently in a molecular state! We may say that the greater weight of evidence seems to favor the idea that the oxygen is in the inactive state and not capable of oxidizing *directly*.

In concluding this short discussion of catalase, we are forced to admit that our knowledge of this subject is very imperfect, and Cohnheim[29] voiced the thoughts of many investigators when he said: "It may well be that catalase is not an enzyme at all, but that the catalytic decomposition of hydrogen peroxide is a function of the large surfaces exposed by colloidal molecules, whether of organized matter or of metals in colloidal solution, the 'inorganic ferments' of Bredig."[30]

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(*To be continued*)

[29] Cohnheim. Lecture at the New York University and Bellevue Hospital Medical College, New York City, December 10, 1909.

[30] Bredig. Die Anorganische Fermente, 1901.

A METHOD OF MAKING LEAF PRINTS

By Edward W. Berry

The following method of making prints of leaves while not new has much to recommend it and seems worthy of having attention called to it in print. It has proven by far the most satisfactory which I have utilized during a life-long interest in leaf study. I do not know the original discoverer, nor does it matter particularly. The process was described in the Scientific American a decade ago and more recently Julia E. Rogers* in "A New Method of Knowing our Tree Neighbors" gives an illustrated account of how it is done, crediting her information to W. W. Gillette, of Richmond, Virginia. The process was deemed of sufficient utility to form the subject of one of the Cornell Home Nature Study leaflets some years ago and finally it has been utilized abroad for a number of years for the purpose of furnishing cheap and accurate reproductions in paleobotanical works of existing leaves with which the fossil leaf species were compared.

The necessary outfit is cheap and simple and consists of a small quantity of printers' ink, a smooth surface eight to ten inches square on which to distribute it, a piece of glass or slate will answer, or a stone slab can be purchased from any printers' supply house for a small sum. Two rollers are needed—one an inking roller such as is used by printers in "pulling" small proofs. This is known technically as a "brayer" and various sizes can be purchased at prices ranging from fifty cents upward. I find that a fifty-cent one answers my purposes very well. The other roller is one such as is used in photographic work either of rubber or faced with rubber and costing from thirty-five cents upward. A small bottle of benzine for cleaning purposes is also useful. The process is as follows: A small quantity of ink, a teaspoonful or less, is placed on the slab and rolled to a thin film with the proof roller. Then the leaf is laid on the slab and carefully rolled with the same roller until a thin film of the ink uniformly coats both sides. The leaf is then placed between

*Country Life in America **18**: 66, 88. 1910.

two sheets of paper and rolled with the photographic roller, care being taken that the pressure be uniform and the paper be not allowed to slip or wrinkle. The result is an accurate and artistic print of both surfaces of the leaf, which should be allowed to become thoroughly dry before handling as the thick

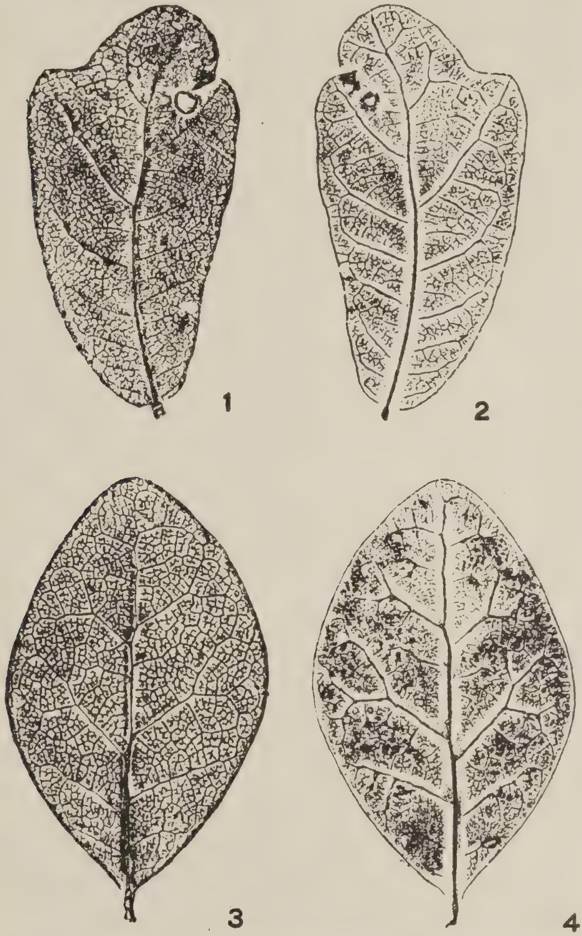

FIG. 1.— 1 and 2. *Quercus Chapmani.* 3 and 4. *Quercus myrtifolia.*

ink offsets and rubs for several hours. These prints when well done can be used for the making of line or half-tone cuts or the same process could be used in making transfers for lithographic

purposes. The various advantages of this process are obvious. As a means of interesting both young and old in becoming acquainted with the trees of their neighborhood this method has no equal and need not be dwelt upon in the present connection. As an aid to paleobotanical work it is also extremely useful. It is not necessary to dry the leaves as fresh ones answer equally well, although dried leaves from the herbarium give equally good prints if they are reasonably flat and not too brittle. The prints show both surfaces as the result of a single operation and the varying appearance of the vascular system on the two surfaces is especially valuable for comparison with fossil leaf impressions. From fifty to one hundred can be made within an hour and with a little practise the results are uniformly excellent. The accompanying illustrations are chosen to show this feature although these particular prints are much less artistic than dozens of other leaf species which might have been selected. The upper figures show the upper and under print of a leaf of *Quercus Chapmani* while the lower figures show the corresponding surfaces of a leaf of *Quercus myrtifolia*, both oaks of our extreme southern states.

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A NEW PLUM FROM THE LAKE REGION OF FLORIDA

BY ROLAND M. HARPER

The lake region of Florida,* which was scarcely known to botanists before the researches of Mr. George V. Nash in 1894,† has yielded a rich harvest of plants new to science, probably at least 75 species, about half of which are not at present known outside of this region. By far the greater number of these were discovered in the central part of Lake County by Mr. Nash in the year named, and many of them were described by him.

*The boundaries and most striking characteristics of this region have been indicated by the writer in Ann. Rep. Fla. Geol. Surv. **3**: 223–224. *pl. 16.* 1911.

†See Bull. Torrey Club **22**: 141–161. 1895.

During the present century very little collecting has been done in this region, but its botanical possibilities are by no means exhausted.

In the southern part of Lake County, especially just west of Lake Apopka, is an area of several square miles characterized by high sandy hills, sometimes known as mountains,* which Mr. Nash never saw. Like most other parts of the lake region, this area is dotted with small lakes, and contains no streams or valleys, and rocks are conspicuous by their absence. The hills under consideration differ from other hills of the region chiefly in being higher and steeper, the summits of some of them being perhaps 150 feet above the lakes at their bases. They are believed by some people to be the highest elevations in Florida, but their altitudes above sea-level have probably never been accurately determined. The vegetation of these hills is uniformly of the "high pine land" type described by Mr. Nash in the paper cited, with the addition of a few species more characteristic of the "scrub," such as *Ceratiola* and *Selaginella*, and a few very local species such as *Polygala Lewtonii* and the shrub presently to be described. The forests have scarcely been touched by civilization, the greater part of them not even having experienced the ravages of the turpentine industry.

On Feb. 19, 1909, just before dark, I first saw these hills from a train on the Tavares & Gulf R. R., which winds about their bases close to Lake Apopka for several miles, and is probably the crookedest railroad in Florida. The next day I walked southward on this railroad from Tavares, the county-seat of Lake County, and reached the northern edge of the hills about ten miles from Tavares and five or six from West Apopka. Almost immediately upon entering the hill country my attention was attracted to some low diffusely branched plum bushes, some of them in full bloom and leafless, and others a little more advanced, with very young leaves and fruit. The bushes were not more than two feet tall, on the average, and about the same in diameter, with branches exceedingly numerous, decidedly

*The most comprehensive description of these hills that I know of, and the one which first called my attention to them, is in Tenth Census U. S. **6**: 237. 1884.

zigzag — somewhat as in *Malapoenna geniculata* — and inclined to be spinescent, as in several other species of plums. The flowers were a centimeter or less in diameter, very short-pedicelled, and arranged in few-flowered sessile umbels, much like those of *Prunus angustifolia*.

At this time I had no collecting apparatus with me, and was not going to be back in Tavares for several hours, so that there was no way of preserving any specimens which would be recognizable; and nearly two months elapsed before I had another opportunity to visit this interesting region. On the morning of April 17 I approached the same group of hills from the southwest side, leaving the same railroad at Minneola; and on some of the highest hills about half way between Minneola and West Apopka (which are about four miles apart in a straight line and ten miles by rail) I found my new plum again in abundance. (I had had glimpses of it two days before from a train between Killarney and Minneola.) The leaves were of course full-grown by this time, and the largest had blades about 2.5 cm. long and petioles about a third of that length. Some were very much smaller, but the average dimensions were probably about three-fourths of the maximum. All were oblong, about twice as long as wide, minutely mucronate at the apex, with finely crenate-serrate margins, and most of them were aggregated on very short peg-like branchlets in the manner of many other woody plants of the Rosaceae and allied families. The drupes, although still green, must have been full-grown or very nearly so, and they were practically indistinguishable from those of *Prunus angustifolia* at the same season. They were about 22 mm. long and 18 mm. in diameter, on stout pedicels about 3 mm. long.

At this time I photographed one of the largest bushes, which was about four feet tall and well loaded with fruit, and made several herbarium specimens from it. Wishing to ascertain the size, color, taste, etc., of the ripe fruit, I revisited the place on the twentieth of the following month, but was too late for it that season. A diligent search failed to reveal a single fruit or even a shriveled remnant of one, not even on the same bush which had furnished my specimens a few weeks before. On May

18, 1910, I came across several specimens of the same plant on somewhat similar high sandy hills about 35 miles farther south, near Haines City, Polk County, but was again too late for fruit.

This peculiar little *Prunus* seems to have its nearest relative—in the eastern United States at least—in *P. angustifolia* Marsh. (*P. Chicasa* Mx.), a large shrub or small tree whose favorite habitat is old fields and fence-rows in regions where agriculture has been practiced for a generation or two at least. The native home of *P. angustifolia*, if it has any, is not definitely known, but is supposed to be somewhere west of the Mississippi River.* The new species differs from *P. angustifolia* in being much smaller in almost every way except its fruit, in its diffuse habit and crooked branches, its short pedicels, and especially in being confined to a very limited area of very poor soil, which may not be cultivated for several decades to come.

The description given above, although incomplete in several particulars, and not arranged in conventional order, will be amply sufficient to enable any one to recognize the plant in the field. Several more seasons may elapse before I have a chance to collect flowers and ripe fruit, and it seems best to give the plant a name without further delay, so that it can be mentioned in descriptions of Florida vegetation. I therefore propose to call it **Prunus geniculata**. Specimens collected at the time and place above mentioned have been distributed as no. 31 of my Florida plants, and have been pronounced undescribed by all systematists who have examined them.

I have recently been informed that there is in the Gray Herbarium a flowering specimen of the same species, collected in March, 1889, by Otto Vesterlund near Killarney, which is on the southwest side of Lake Apopka, where the Tavares & Gulf R. R. crosses the "Orange Belt" division of the Atlantic Coast Line, a few miles southeast of West Apopka.

*For notes on its supposed origin, present habitat, etc., see Michaux, Fl. Bor. Am. 1: 284–285. 1803; Pursh, Fl. Am. Sept. 332. 1814; Nuttall, Genera 1: 302. 1818; Elliott, Bot. S. C. & Ga. 1: 542. 1821; Sargent, Tenth Census U. S. **9**: 66. 1884; Silva N. A. **4**: 25–26. 1892; Mohr, Contr. U. S. Nat. Herb. **6**: 551. 1901; Harper, Ann. N. Y. Acad. Sci. **17**: 115, 228. 1906; Bull. Torrey Club **35**: 350. 1908.

PROCEEDINGS OF THE CLUB

January 10, 1911

The first meeting of the Club for 1911 was held at the American Museum of Natural History, beginning at 8:25 P.M., President Rusby in the chair. There were nineteen persons present. Dr. C. A. Darling, of the department of botany, Columbia University, was nominated for membership.

This being the annual meeting, reports were presented by the various officers.

The report of the Treasurer was presented and upon motion referred to an auditing committee.

The Secretary reported that fifteen meetings had been held during the year with a total attendance of 467, as against 411 in 1909, and an average attendance of thirty-one, as against twenty-seven last year. Twelve persons have been elected to membership, and eight resignations received and accepted. Six illustrated lectures were delivered during the season at which the combined attandance was 319, as against 251 at seven meetings last year.

The Editor reported that the Bulletin for the year 1910 contains 630 pages and 36 plates, and that the expense of its publication was less than the amount allowed for it by the Budget Committee. He also reported that only one paper had been published in the Memoirs, this being a paper by Dr. O. Butler on The Californian Vine Disease. The Editor declined to be considered for reëlection. His detailed report is appended.

The Editor of Torreya presented a special report for that periodical. The volume of Torreya for 1910 contained 292 pages.

The chairman of the Field Committee reported that twenty-three meetings were advertised during the year, one of which was an afternoon lecture at the New York Botanical Garden. Eight meetings were not held on account of stormy weather or from other causes. At the fourteen field meetings actually held there was a total of 103 persons present, making an average attendance of a little more than seven at each meeting.

As chairman of the Local Flora Committee, Dr. N. L. Britton gave a brief report of the investigations being carried on by Mr. Norman Taylor on the local flora.

Election of officers for the year 1911 resulted as follows:

President, H. H. Rusby.

Vice-presidents, Edward S. Burgess and John Hendley Barnhart.

Secretary and Treasurer, Bernard O. Dodge.

Editor, Philip Dowell.

Associate Editors, John Hendley Barnhart, Jean Broadhurst, Ernest Dunbar Clark, Alexander William Evans, Tracy Elliot Hazen, Marshall Avery Howe, Herbert Maule Richards and Norman Taylor.

The following committees were appointed by the President for the year 1911:

Finance Committee, John I. Kane, H. M. Richards.

Program Committee, Elizabeth G. Britton, Fred J. Seaver, Tracy E. Hazen and Jean Broadhurst.

Field Committee, E. B. Southwick, William Mansfield and Norman Taylor.

Committee on Local Flora, N. L. Britton, *Chairman*. Phanerogams: N. L. Britton, C. C. Curtis, E. P. Bicknell, K. K. Mackenzie, E. S. Burgess and E. L. Morris. Cryptogams: Wm. A. Murrill, E. G. Britton, Tracy E. Hazen, M. A. Howe and Philip Dowell.

Budget Committee, H. H. Rusby, E. S. Burgess, J. H. Barnhart, B. O. Dodge, Philip Dowell and N. L. Britton.

A motion was made by Dr. M. A. Howe that for the ensuing year the offices of secretary and treasurer shall be held by one person; that the secretary and treasurer shall be instructed to assist the editor by preparing the annual volume indexes for the Bulletin and Torreya, by selecting the titles and preparing the copy for the Index to American Botanical Literature, and by distributing to subscribers the Card Index; that in consideration of the demands upon his time and attention, the secretary and treasurer shall receive from the funds of the Club the sum of $300 a year, payable in equal monthly instalments, and that

this amount shall be he'd to include any disbursements by him for clerical assistance.

The motion was carried.

Resignations were read and accepted from Mr. Macy Carhart and Mr. Gifford Pinchot.

Adjourned.

PERCY WILSON,
Secretary.

OF INTEREST TO TEACHERS*

THE SCIENTIFIC SPIRIT

Under "Practical Science" Professor John M. Coulter discusses (*Science*, June 10, 1910) the scientific attitude of mind or the scientific spirit. He describes three of its useful characteristics: First, that it is a spirit of inquiry, and in connection with this he makes the statement that it "is not the spirit of unrest, of discomfort, but the evidence of a mind whose every avenue is open to the approach of truth from every direction. For fear of being misunderstood, I hasten to say that this beneficial result of scientific training does not come to all those who cultivate it, any more than is the Christ-like character developed in all those who profess Christianity. I regret to say that even some who bear great names in science have been as dogmatic as the most rampant theologian. But the dogmatic scientist and theologian are not to be taken as examples of 'the peaceable fruits of righteousness,' for the general ameliorating influence of religion and of science are none the less apparent."

Second, it is a "spirit which demands that a claimed cause shall be demonstrated. It is in the laboratory that one first really appreciates how many factors must be taken into the count in considering any result, and what an element of uncertainty an unknown factor introduces. Even when the factors of some simple result are well in hand, and we can combine them with reasonable certainty that the result will appear, we may be entirely wrong in our conclusion as to what in the combination has produced the result. For example, the forms of certain

* Conducted by Miss Jean Broadhurst, Teachers College, Columbia University.

plants were changed at will, by supplying to their surrounding medium various substances. It was easy to obtain definite results, and it was natural to conclude that the chemical structure of these particular substances produced the result, and our prescription was narrowed to certain substances. Later it was discovered that the results are not due to the chemical nature of the substances, but to a physical condition developed by their presence, a condition which may be developed by other substances or by no substances, and so our prescription was much enlarged."

Professor Coulter calls attention to the fact that the "prevailing belief among the untrained is that any result may be explained by some single factor operating as a cause. They seem to have no conception of the fact that the cause of every result is made up of a combination of interacting factors, often in numbers and combinations that are absolutely bewildering to contemplate." Though it is fortunate when leaders, as in public opinion, "have gotten hold of one real factor," this habit of "considering only one factor, when perhaps many are involved, indicates a very primitive and untrained condition of mind."

Third, this spirit keeps one close to the facts. "There seems to be abroad a notion that one may start with a single well-attested fact, and by some logical machinery construct an elaborate system and reach an authentic conclusion, much as the world has imagined that Cuvier could do if a single bone were furnished him. The result is bad, even though the fact may have an unclouded title. But it happens too often that great superstructures have been reared upon a fact which is claimed rather than demonstrated. Facts are like stepping stones; so long as one can get a reasonably close series of them he can make some progress in a given direction, but when he steps beyond them he flounders. As one travels away from a fact its significance in any conclusion becomes more and more attenuated, until presently the vanishing point is reached, like the rays of light from a candle."

Such 'vain imaginings' are "delightfully seductive to many people, whose life and conduct are even shaped by them. I have

been amazed at the large development of this phase of emotional insanity, commonly masquerading under the name of 'subtle thinking.' Perhaps the name is expressive enough, if it means thinking without any material for thought. And is not this one great danger of our educational schemes, when special stress is laid upon training? There is danger of setting to work a mental machine without giving it suitable material upon which it may operate, and it reacts upon itself, resulting in a sort of mental chaos. An active mind, turned in upon itself, without any valuable objective material, certainly can never teach any very reliable results. It is the trained scientific spirit which recognizes that it is dangerous to stray away very far from the facts, and that the farther one strays away the more dangerous it becomes, and almost inevitably leads to self-deception.

This Professor Coulter feels is the attitude of mind that scientific training is contributing to the service of mankind—contributing as an ideal which is already yielding tremendous results, and as a force accumulating momentum for a larger expression.

In response to appeals from various scientific bodies, the Smithsonian Institution has concluded the preparations for a biological survey of the Panama Canal Zone. Friends of the Institution have contributed funds for the expenses of the investigators, as it is felt a properly conducted survey would yield important scientific results. "It is known that a certain number of animals and plants in the streams on the Atlantic side are different from those of the Pacific side, but as no exact biological survey has ever been undertaken, the extent and magnitude of these differences have yet to be learned. It is also of the utmost importance to determine exactly the geographical distribution of the various organisms inhabiting those waters, as the Isthmus is one of the routes by which animals and plants of South America have entered North America and *vice versa*. When the canal is completed the organisms of the various watersheds will be offered a ready means of mingling together, the natural distinctions now existing will be obliterated, and the data for a true understanding of the fauna and flora placed forever out of reach."

"By the construction of the Gatun Dam a vast freshwater lake will be created, which will drive away or drown the majority of the animals and plants now inhabiting the locality, and quite possibly exterminate some species before they become known to science."

Miss Graham, studying *Conocephalum conicum* (*Fegatella conica*), finds that at Ithaca, N. Y., the gametophores begin to appear in June, that fertilization takes place about the first of July, that the spores are fully formed before the beginning of winter, and that in the following May the gametophore stalk rapidly elongates. This elongation is quickly followed by the elongation of the stalk of the sporogonium. The venter of the archegonium is two-layered at the time of fertilization, and soon becomes a massive calyptra. The first division of the fusion nucleus gives rise to free nuclei, which may lie parallel with or transversely to the major axis of the archegonium. A cell wall is not laid down until some little time has elapsed after division of the fusion nucleus; when the wall appears, it is transverse. By successive transverse divisions a filament of four or five cells is formed. This observation differs from that of Cavers, who described an octant stage. The first longitudinal walls appear in the outer or capsule end of the filament. At the time of separation of the mother cells, the growth of the capsule is checked, while the calyptra continues growth, leaving quite a space between capsule and calyptra. The capsule and seta soon resume growth, fill the cavity, and distend the calyptra. No pseudoperianth, such as is found in *Marchantia*, is present. A sheath, which is a specialized portion of the gametophore, invests the calyptra. (W. J. G. Land, *Botanical Gazette*, February.)

Duncan S. Johnson, in the December *Journal of the New York Botanical Garden* calls attention to a heavy flood (November and December, 1909) in the Blue Mountain region of Jamaica, in which "scores of acres of coffee fields were stripped to the bare rock" and "even the primeval forest of the valley bottoms was swept out and carried down to the sea." The "gray desert"

appearance in June, 1910, is described, and the sparse and hardly typical new growth is noted. It is expected that this "occupation of a virgin soil by a new plant covering" will prove as interesting as that previously described after the volcanic disturbances at Krakatoa. It certainly adds a new type to the work previously done at Krakatoa and along the ocean, and to that now being conducted at the Salton Sea.

A paper by C. V. Piper on botany in its relation to agricultural advancement, too varied to be abstracted here, appeared some months ago in *Science* (June 10, 1910). Hybrids, sports, and other plant variations—especially with reference to cultivated or agricultural plants are discussed in a way to be interesting even to the general reader.

The Nature Study Review for November, 1910, contains two articles of interest to high school teachers. One is by Alice J. Patterson on potatoes and oats as nature study topics. It includes much in subject matter and method that would be helpful in the first year high school classes. The cuts are especially interesting. The first is of the first potato introduced into Europe from a water color of 1588 by Clusius; the second shows potato *fruits*, about one inch in diameter.

The second article is by Frederick L. Holtz on weeds, the common kinds, and the methods of eradicating them. It is in a form suitable for high school reading.

The question of coastal subsidence is discussed again in a recent *Science* (January 6, 1911) by H. H. Bartlett. Conditions near Buzzard's Bay where fresh water peat is found fourteen feet below sea level are given as proof of subsidence which is still going on. The controversy is continued in the same journal (January 13 and February 24). In the latter issue D. S. Johnson writes to explain some of the facts used by Mr. Bartlett, in a way that leaves coastal subsidence very much of an open question.

NEWS ITEMS

From a recent number of the *Times* we learn that the United States Bureau of Fisheries will send the steamer Albatross on a scientific cruise, and by special arrangement the American Museum of Natural History of New York will coöperate. The Albatross will sail from San Diego, Cal. Collecting parties will be landed in lower California to gather specimens of birds, reptiles, mammals and of the plant life of the coast. The New York Zoölogical Society and the New York Botanical Garden will be represented in these landing parties. The Gulf of California will be explored and the pearl shell fisheries studied with a view to transplanting pearl shell oysters to Florida waters.

Professor V. R. Gardner has been appointed associate professor of pomology at the Oregon Agricultural College to succeed Professor C. A. Cole, who has resigned.

During 1910 over three million persons visited the Royal Botanic Gardens, Kew. The greatest day's attendance was 152,454.

The University of Colorado Mountain Laboratory at Tolland, Colorado, begins its third session June 19, 1911. Courses in systematic botany, plant ecology, algology and field biology (plant and animal). The laboratory is at 8889 ft. and offers varied conditions for study. Pamphlet may be obtained from Dr. Francis Ramaley, University of Colorado, Boulder, Colorado.

Recent visitors at the New York Botanical Garden include Dr. Ezra Brainerd, Dr. W. C. Coker, Dr. Marie Stopes of Manchester, and Dr. C. F. Millspaugh en route to the Bahamas. Dr. and Mrs. N. L. Britton have gone to Cuba, and Dr. Small has returned from explorations in Florida.

The board of the University of Iowa has definitely decided to provide a special building for the collections of Prof. Calvin and Dr. T. H. Macbride, whose work on the geology and botany

of Iowa has heretofore been handicapped by lack of adequate room.

Contributors to TORREYA are requested to note the change of address of Mr. Norman Taylor, the editor. After March 16 letters should be sent to Central Museum, Eastern Parkway, Brooklyn, N. Y.

Volume 1, No. 1 of *Phytopathology*, the official organ of the American Phytopathological Society has just appeared. The editors are L. R. Jones, C. L. Shear, and H. H. Whetzel.

The biological laboratory of the Brooklyn Institute of Arts and Sciences at Cold Spring Harbor, L. I., announces summer courses in botany as follows: Cryptogamic botany, Ecology, special advanced work in either of these subjects, and other studies of a more general character. For further information address Prof. F. W. Hooper, Academy of Music, Brooklyn, N. Y.

TORREYA

April, 1911

Vol. 11 No. 4

SOME FLORAL FEATURES OF MEXICO*

By H. H. Rusby

At a rough estimate, two thirds of Mexican territory is arid, and nearly half of this can be considered a desert, in that it cannot naturally support grazing animals.

The fertile region includes (1) the lowland of the south, with a tropical climate, and amidst which there are numerous mountains possessing a subtropical, or some of them even a temperate climate, and which gradually changes into an arid region as it rises into the central table-land; (2) an eastern or Gulf Coast strip which, gradually narrowing, extends from the southern tropics clear up into Texas; (3) a Pacific Coast strip which, narrow at all points, gives way northward to the desert region of and adjacent to the Peninsula of California.

Within these boundaries, and stretching to the Rio Grande, is the arid region, of which more than the northern half, and especially the northwestern portion, is a real desert.

This, with the exception of its western part, is the region best known to tourists and visitors, for the reason that the main lines of travel run directly through it from north to south. It presents the same general aspect as the country through which the Southern Pacific Railroad runs from western Texas to Los Angeles. If one passes through it toward the close of the dry season, which extends in its most favorable sections from December to July, and in its most unfavorable ones begins nearly two months earlier, he encounters a region of torrid heat and

*Abstract of an illustrated lecture delivered to the Torrey Botanical Club, February 14, 1911.

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intense dryness, in which every motion stirs up a copious, fine, penetrating dust which keeps one covered as long as he remains in it. At this time, the landscape is almost unvaryingly bare and of various shades of gray, brown and red. Flowers are almost wanting, although this is a favorite blooming time with many cactuses, and there are some other succulents, such as jatrophas, which then begin to bloom.

Not only does the period of rains differ greatly in different parts of this arid region, but the amount of rain shows remarkably wide limits of variation. Even where there is but little, a surprising change occurs in the aspect of the country after its occurrence. Within a month, the ground acquires a more or less nearly complete covering of grasses and is carpeted in patches, often large ones, with solid masses of bloom, and the appearance of the surface is abundantly broken by patches of flowering shrubs.

The most conspicuous objects on these plains are yuccas, agaves, flat and cylindrical jointed opuntias, covilleas, *Proso-*

FIG. 1. The Balsas River.

pis, and artemisias. The opuntias grow almost everywhere. yuccas of some species are almost as generally distributed,

though the very large and conspicuous ones are confined to certain districts. Agaves are mostly confined to the mountains or rocky places. Of all these plants, the most striking is a giant branching yucca, reaching a height of twenty feet or more, which bears its dense panicles of white flowers, more than a yard in length and two thirds as broad, in a strictly pendulous position. The larger shrubby growth is mostly mimosaceous, consisting of *Prosopis* and *Acacia*, with smaller mimosas and calliandras about their bases.

Very frequently the *Prosopis* attains the dimensions of a good-sized tree, though this more commonly occurs as we are entering the fertile or semi-fertile southern districts. It is very rare that we encounter streams in this region, though arroyos, carrying water in the rainy season, are seen in all directions. In such locations, where there is a water supply not too far below the surface, a fringe of cottonwoods and pepper trees may be seen.

The herbaceous patches of bloom, to which reference has been made, consist chiefly of Compositae, especially *Pectis*, *Actinella*, *Layia*, *Melampodium*, and taller *Baileya*, *Coreopsis*, *Grindelia* and *Gymnolomia*. There are also many tuberous rooted ipomeas and oxalids.

Everywhere in sight are mountains of enormous height, many of their slopes being apparently inaccessible. Their appearance, for the most part, is even more arid than that of the plains, but since they receive much more frequent and copious showers, their upper portions probably possess a rich and interesting flora. It has never been my lot to ascend any of them.

The northwestern desert region I have never visited, and I must say the same of the eastern coast, so that I shall not attempt a description of those regions.

The transition from this desert table land, where the production of cultivated crops without irrigation is impossible and where water for irrigation is not to be had, by any present methods, is of great interest. It must be stated, however, that in some places portions of the desert have been brought under cultivation by means of a water supply obtained either

from rivers or artesian wells, and here the soil has been found of great fertility, so that there is hope of eventually redeeming a large portion of this desert.

The first change noticed, a little more than half-way from the United States border to the City of Mexico, is a more liberal water supply, encouraging extensive tillage by irrigation methods. A little farther south we find that although irrigation is very largely resorted to, it is possible to produce such crops as corn through the unaided agency of the rainy season. The rapidity with which such crops grow and attain maturity at this time is indeed remarkable.

Most of my own field work in Mexico has been performed in this semi-arid region, so that I have had an opportunity to become rather well acquainted with the general features of its

FIG. 2. Lava Beds along Cuernavaca R. R.

flora, while not having found time to determine many of the species encountered. One of the most noticeable sights to the visitor from the north is that of the vast fields of maguey or century plant, used for the manufacture of the fermented beverage pulque and its distillate, mezcal. Its buds, taken just before flowering, resembling huge cabbages and occasionally a hundred

pounds or more in weight, are baked into a sugary mass which is eaten as a sort of sweet conserve. In these cultivated lands, the *Prosopis* becomes a tree, much resembling a spreading oak, or even a large apple tree. These trees are left standing in the cultivated ground and their branches become the support for stacks of hay or other fodder, thus placed out of reach of marauding animals.

In the vicinity of Iruapato, vast areas are devoted wholly to the culture of the strawberry, irrigation by the use of shallow wells being resorted to, and the delicious fruit being supplied throughout the year. The natural aspects of the vegetation here have largely disappeared, owing to the fact that the land is almost wholly cultivated, but in the waste places there is a rich and varied herbaceous and suffrutescent flora. In many places the steep hillsides and narrow valleys are used only for grazing purposes and here there is often a dense covering of large shrubs or small trees. In some places these trees consist largely of junipers, intermingled with *Acacia*, *Prosopis*, *Arctostaphylos* and cotton-woods, while along the edges of the streams the beautiful and often enormous Mexican cypress begins to appear. A specimen of the last-named tree, growing in Oaxaca and called "the Tule," is one of the largest trees in the world. A strange and very showy effect is sometimes produced amidst this arborescent hill growth by the abundance of loranthaceous parasites which it supports. Much of this parasitic growth consists only of *Phoradendron*, and is merely green or yellowish green, but at times the crowns of the trees in all directions will be seen invaded by masses of brightly colored members of this family, the entire mass glowing with brilliant scarlet, crimson or yellow. Sometimes almost the entire crown of a juniper tree will be occupied by such a growth. During the rainy season many of the natural hollows will be converted into pools, sometimes acquiring the dimensions of small lakes. In addition to these natural deposits of water, artificial ones are created by the farmers, wherever there is a sloping surface which can be dyked with mud at its lower boundaries, so that one sees so much water as to create the impression that he is in a country of

marshland. Around the margins of such pools, especially the natural ones, there is frequently seen a broad band of pink or purple *Cosmos*, sometimes a hundred yards or more in breadth and presenting a solid mass of color. Similar patches of yellow *Helianthus*, *Coreopsis* and related genera are abundant.

These are the conspicuous features of the flora, as viewed by one who is passing through it. When we dismount and walk over these hills and through the valleys, our interest centers in the wonderful variety of small annual and perennial herbs, both as to species and larger groups, which crowd into every undisturbed spot.

In the foothills of the mountains of this region, the botanist becomes quite lost in the profusion of unfamiliar plants. The acacias and Prosopids exist in undiminished abundance and, growing among them so thickly as to make travel difficult, are numerous species of *Terebinthus*, or *Bursera*, spiny erythrinas bearing long moniliform pods showing brilliant scarlet seeds through their half-opened sutures, stinging jatrophas, intricately thorny Rubiaceae and small silk-cotton trees, and all these frequently bound together by twining *Clematis*, *Passiflora*, *Thomaea* and leguminous vines. Many of the smaller shrubs also are leguminous, among them the beautiful *Brongniartia*, with silky-white herbage and lovely dark chocolate-colored flowers. In some places the arborescent growth is almost wholly of the Palo Amarillo rubber-tree, *Euphorbiodendron fulvum*. Extremely varied are the lantanas, their flowers ranging in color from pure white or white with a golden eye, through various shades of pink and purple, even to brilliant orange or vermilion. Almost equally abundant and varied are the species of *Stevia*. Among the herbaceous vegetation, purple flowered *Oxalis* exists in great variety, with many Geraniums, purple flowered ruellias and Nyctaginaceae, and yellow *Tribulus*. Ferns of the hardier kinds, such as rigid pellaeas and notholaenas, are frequent, but not nearly so abundant as farther south. Where the canyons open out into valleys leading to the plains, the Cactaceae comprise the greatest bulk and the most interesting feature of the flora. In places the entire surface over many

acres is so intricately covered with opuntias that travel is slow and difficult. At first sight, and until one has become accustomed to their examination, all seem to be slightly variable forms of a single species, but one presently becomes aware that the variations, however numerous and slight, are constant. If he is then fortunate enough to secure the companionship of a competent and experienced mountaineer, he will learn that all these forms, and more than he has differentiated, are distinguished by names and that the differences between them, such as the shade of green of the surface, the form and relative thickness of the joints, the shade of color of the flowers, their time of appearing and the color, especially the internal color, of the fruits, and their edible properties, are all well defined by the natives. I am strongly of the opinion that the relation between the present state of our knowledge of the Mexican opuntias, and that of the future, is much like that of our knowledge of American *Crataegi*

FIG. 3. *Vitis blanco* Munson.

of ten years ago as compared with that of the present. Some of these flat-jointed opuntias are old and large trees, with trunks two feet or more in diameter. The huge, widely and densely branching *Myrtilocactus* is often conspicuous and abun-

dant. Its small, delicious fruit is an important article of trade, under the name of "Garambulla."

As we approach the valley of Mexico, we come into a more fertile region, producing tropical fruits and other products indicating the rich luxuriance which we are to encounter after another day's journey to the south or east. The mountain flora of the vicinity of Mexico is of special interest and beauty. Here there are many species of salvia, oxalis, verbena, geranium, *Solanum*, etc. Terrestrial orchids are decidedly numerous, though scarcely abundant, and the instant that we penetrate to the warm and moist valleys, even quite near to the city, interesting and handsome arboreal species begin to appear. Arboreal ferns, tillandsias and other bromeliads are also numerous. In rich places among the rocks dahlias of various colors are common and abundant.

(*To be continued*)

THE NATURE AND FUNCTION OF THE PLANT OXIDASES

By Ernest D. Clark

(*Continued from March Torreya*)

Function of the Oxidases in the Plant

Physiology

It is evident from the preceding chapters that oxidizing enzymes are very widely distributed. Since enzymes generally seem to be produced by plants or animals for some definite purpose in the life of the organism, it was natural that speculation should arise regarding the function of the oxidizing enzymes. Their usefulness to the plant probably lies in their power to act as accelerators of the ordinary processes of oxidation as we shall see in a closer study of their function in the plant.

The oxidases, more especially peroxidase and occasionally oxygenase, are found in seeds and seem to bear some relation

to the age of the seed, state of germination, etc. Brocq-Rousseu and Gain[30a] examined the seeds of species of plants from many different families. They used both guaiac tincture and guaiacol with the addition of hydrogen peroxide as tests for peroxidase or "peroxydiastase," as they called it. Peroxidase was present in nearly all seeds examined, the amount decreasing with their age; however, in kernels of corn they found peroxidase after the corn had been standing for over two hundred years. They further noted that oxygenase was rarely present in the seeds, and also that the strongest test for peroxidase was given by the embryo. Bialosuknia[31] made glycerine extracts of resting and germinating seeds, testing these extracts for oxidases with guaiac tincture, indophenol reagent, benzidin, etc. Peroxidase was present in the resting seeds and at all stages of germination, while oxygenase (direct oxidase) could not be detected in the seeds before the second day, after which it was always present. Deleano[32] also made a study of the germination of seeds, getting the same results as those obtained by Bialosuknia. The catalase increased rapidly and then disappeared along with the fat. He found further that reductase (reducing enzyme) was present and that it was localized in the protein part of the seed. Issajew[33] made a careful study of the oxidase of germinated barley, his results agreeing with those of the other investigators already noted. He found the same increase of oxidases after germination and confirmed the presence of the so-called reducing enzymes under these conditions.

In the study of oxidizing substances and enzymes in biological materials, it soon became apparent that in many cases there occurred reducing substances along with the oxidases, etc. Frequently these reducing substances were called enzymes and given special names, such as the "philothion" of Rey-Pail-

[30a] Brocq-Rousseu and Gain. Sur l'existence d'une peroxydiastase dans les graines seches. Compt. Rend. Acad. Sci. **145**: 1297. 1907.

[31] Bialosuknia. Ueber Pflanzen-Fermente. Zts. Physiol. Chem. **58**: 487. 1908.

[32] Deleano. Recherche chemique sur lar germination. Centralbl. f. Bakt., II. Abt. **24**: 130. 1909.

[33] Issajew. Ueber die Malzoxydase. Zts. Physiol. Chem. **45**: 331. 1905.

hade,[34] who in 1888, announced that in beer yeast he had found a substance which caused the evolution of hydrogen sulphide from sulphur, even in the cold. In the potato, egg-plant, etc., Kastle and Elvolve[35] found that there were substances which reduced nitrates to nitrites, the most favorable temperature for this action being from 40° to 50°; the action being retarded by acids and much increased by benzaldehyde and benzyl alcohol. Action is also completely checked by boiling, but the authors hesitated to say that this action is due to an enzyme; they classified this reducing substance with those compounds that are unstable and easily oxidized, and which reduce nitrates, but not in unlimited quantity. This statement might also be applied to the so-called reducing enzymes found by Irving and Hankinson[36] in the Gramineae. In the action of both yeast and bacteria, reducing substances probably play a part, since they are usually present.

We may say, then, that reducing substances are of common occurrence in plants, both in the higher and lower representatives. In many plant juices there occur reducing substances which, in the test for oxidases with the color reagents, gradually decolorize all the mixture except a zone near the surface of the liquid; this upper colored part being immediately bleached if the solution is thoroughly shaken, but it reappears upon standing. These reducing substances, as well as catalase, may act as a check upon the activity of peroxidase in the living cell, but after death or narcosis, the production of reducing substances is lessened and the oxidases develop pigments, *i. e.*, oxidize the chromogens to colored compounds. It seems doubtful that these reducing substances are enzymes, since we know that ordinary reducing substances resulting from metabolism are present in practically all animal and plant cells. Such substances

[34] Rey-Pailhade: (*a*) Nouvelle recherche physiologique sur la substance organique hydrogénant le soufre à froid. Compt. Rend. Acad. Sci. **107**: 430. 1888. (*b*) Sur une corps d'origine organique hydrogénant le soufre à froid. Compt. Rend. Acad. Sci. **106**: 1683. 1888.

[35] Kastle and Elvolve. The Reduction of Nitrates by Certain Plant Extracts, etc. Am. Chem. Jour. **31**: 606. 1904.

[36] Irving and Hankinson. The Presence of Nitrate Reducing Enzymes in Green Plants. Biochem. Jour. **3**: 87. 1908.

may be formed by photosynthesis and in the metabolism of the plant. Heffter[37] believed that the so-called reducing enzymes are not enzymes at all, but that the reducing action is due to the decomposition products of protein, especially those containing the SH group. This, however, is denied by Fränkel and Dimitz[38] who believe that the reducing power of cells is due to their unsaturated fatty substances.

It seems likely that the oxidizing ferments assist in carrying on the oxidative processes of respiration by increasing the rapidity of the combination of oxygen with the oxidizable substances in the plant. It has long been known that there are certain plants which at times develop a temperature above that of their surroundings, representatives of the Araceae showing this peculiarity in a striking manner. Hahn[39] investigated this phenomenon in *Arum maculatum*, the spadix of which is often from 20° to 27° C. warmer than the surrounding air. He used press-sap from the spadix of the plant and found that upon exposure to the air, the liquid rapidly became greenish black; so he concluded that an oxidizing enzyme (tyrosinase) was present. Hahn allowed the press-sap to remain at 25° for several days and at the end of that time the content of sugars, originally high, dropped to nothing, with accompanying loss of weight in the carbon dioxide evolved. This process could be entirely prevented by heating the press-sap to 60° for half an hour before allowing it to stand. Furthermore, the same process took place in an atmosphere of hydrogen; so Hahn thought he was dealing with a case of intra-molecular respiration carried on by oxidizing enzymes. Krause[40] noticed a similar elevated temperature with loss of dry weight [probably carbohydrates] in *Arum italicum* and Knoch[41] did so in the case of the flower of *Victoria Regia*

[37] Heffter. Die reduzierenden Bestandtheile der Zellen. Med. Naturwiss. Arch. **1**: part 1, p. 15. 1907.

[38] Fränkel and Dimitz. Gewebatmung durch Intermediärekörper. Wiener klin. Wochensch. 1909: No. 51, p. 1777.

[39] Hahn. Chemische Vorgänge im zellfreien Gewebsaft von *Arum maculatum*. Ber. Chem. Gesell. **33**: 3555. 1901.

[40] Krause. Ueber die Blütenwärme von *Arum Italicum*. Abhandl. Naturfor. Gesell. zu Halle, 1882, p. 16.

[41] Knoch. Untersuchungen über den Physiologie, etc., der Blüte von *Victoria Regia*. Diss. Marburg, 1897.

at the time of the opening of its petals. As we have seen, the many striking changes of color in plants after injury with the resulting exposure to the atmospheric oxygen, have long been subjects of investigation, but until recently such research was confined to studies of the enzymes involved, to the consequent neglect of the chromogens affected by these enzymes. In studying the rôle of the oxidases, if we were to consider only the enzymes, we should be neglecting the other half of the problem, for the chromogens occurring in plants are the sources of all the colorations and may very well act as oxygen carriers in the metabolism of the plant. Even in 1882 Reinke[42] interested himself in the substances in the plant which gave colored oxidation products under the influence of oxidases and of the air. The juice of the potato and of the white beet contained a chromogen which became dark upon standing in the air, but it was easily changed back to its original colorless state by reducing agents or by certain bacteria. He thought that the colorless condition of the chromogens in the living cell is due to accompanying reducing substances, or else that the cell is able to oxidize the chromogens through the colored state to a more highly oxidized colorless condition.

To show the distribution of these chromogens among plants this outline, adapted from Chodat,[43] is given (the changes being from colorless to that indicated):

Yellow, to green, then to blue—*Boletus spp.*

Red, violet and then black—many of the higher fungi, especially Agaricaceae; wheat seedlings, potatoes, apples, nuts, *Lathyrus niger*, secretions of certain ink-fish, etc.

Brown, then black—*Rhus succedana*, etc.

Violet-red—*Jacobinia spp.*[44]

Black—the higher fungi, especially *Hygrophorus spp.*; *Monotropa uniflora* and *Viburnum lantana.*

[42] Reinke. Ein Beitrag zur Kenntniss leicht oxidirbarer Verbindungen der Pflanzen-körpers. Zts. Physiol. Chem. **6**: 263. 1882.

[43] Chodat. Chapter on the "Oxydases" in Abderhalden's Handbuch der Biochem. Arbeitsmethoden, III, 2d part, p. 42 ff. 1910.

[44] Parkin. On a Brilliant Pigment Appearing after Injury in Species of Jacobinia Report Brit. Ass'n Advancem. Sci. 1904, p. 818.

Palladin[45] and his collaborators have taken up the question of the rôle of the chromogens and the oxidases in the respiration of the plant. They have followed out the general line of thought first conceived by Reinke. They have published many papers on the subject which cannot be abstracted here in detail, but a general outline of their results and conclusions will be given. In the anaerobic respiration of seeds, alcohol, acetone, and substances of aldehyde nature were obtained. Oxygenase increases with the growth of the part containing it. Both oxygenase and peroxidase are much increased by feeding the plant freely with sugars. The chromogens also increase under such circumstances. Palladin made a systematic search for the respiratory chromogens, and found they were very wide-spread and were generally red or brown when oxidized. To detect the chromogens he ground the plant material under water and thus obtained a light-colored solution to which he added peroxidase (from horseradish) and hydrogen peroxide; if the chromogen were present, it was soon oxidized and caused the solution to darken. In this manner he found that of seventy-one different plants examined, sixty-seven contained chromogens and that the parts with an active respiration like flowers, young shoots, etc., showed the greatest amount of respiratory chromogen. Chloroformed plants soon began to show coloration due to the oxidation of their chromogens. These chromogens seem to be derivatives of the cyclic series, and Palladin considered that they often occur in the form of glucosides, which, by the action of glucoside-splitting enzymes, are separated from the sugars and then take up oxygen by the aid of the oxidases, thus becoming colored. During the normal life of the plant there is a coördinated action of these hydrolytic, oxidizing, and reducing enzymes, which prevents oxidation of the chromogens, but during narcosis or after death,

[45] Palladin: (*a*) Die Atmungspigmente der Pflanzen. Zts. Physiol. Chem. **55**: 207. 1908. (*b*) Die Verbreitung der Atmungschromogene bei den Pflanzen. Ber. Bot. Gesell. **26a**: 378. 1908. (*c*) Ueber das Wesen der Pflanzenatmung. Bioch. Ztsch. **18**: 151. 1909. (*d*) Ueber die Bildung der Atmungschromogene in den Pflanzen. Ber. Bot. Gesell. **26a**: 389. 1908. (*e*) Die Arbeit der Atmungsenzyme der Pflanzen, etc. Zts. Physiol Chem. **47**: 407. 1906. (*f*) Ueber die Prochromogene der Pflanzen-Atmungschromogene. Ber. Bot. Gesell. **27**: 101. 1909.

the inter-relation of these enzymes is disturbed, with the result that the respiratory chromogens become evident by their color. The fact that these respiratory chromogens may take up oxygen and later give it up again under the influence of reducing substances, led Palladin to call the respiratory chromogens the "phyto-haematins" because he thought they were similar to the oxygen-carrying pigments of the blood of animals.

This work of Palladin and his students upon respiratory chromogens is a valuable contribution to our knowledge of the respiration of plants. His conception of the respiratory pigments as being cyclic compounds bound to the sugars in the form of glucosides which are insoluble, seems to be founded on fact. In the case of indigo-blue, according to Walther[46] and also in the case of many other pigments, the chromogen is held in the insoluble glucoside form, from which it is separated by the hydrolytic enzymes to give sugars, and then the oxidases attack the chromogen thus set free, imparting to it a definite color. In *Schenckia blumenaviana*, Molisch[47] found that the green plant became red upon treatment with chloroform vapor. This result he attributed to the action of an enzyme upon a chromogen in the plant. In certain of the Dipsacaceae, Miss Tammes[48] demonstrated the presence of a colorless chromogen dipsacan which, under the influence of oxidases, was changed to a blue pigment called dipsacotin by this investigator. Miss Wheldale[49] believes that the red colorations of certain leaves and flowers are caused by anthocyan, a pigment resulting from the coördinated action of oxidases and hydrolytic enzymes. She also considers that the color or lack of color in the offspring of such plants is due to the action of oxidases and reducing substances, etc., as factors in heredity. Overton[50] and also Tswett[51] came to the con-

[46] Walther. Zur Frage der Indigo-bildung. Ber. Bot. Gesell. **27**: 101. 1909.

[47] Molisch. Ueber ein neues, einen karminroten Farbstoffe erzeugendes Chromogen bei *Schenckia blumenaviana*. Ber. Bot. Gesell. **19**: 149. 1901.

[48] Miss Tammes. Dipsacan und Dipsacotin, ein neues chromogen und neues Farbstoffe der Dipsaceae. Recueil. Trav. Bot. Néerland. **5**: 51. 1908.

[49] Miss Wheldale. Plant Oxydases and Chemical Relationships of Color Varieties. Prog. Rei. Botan. **3**: 457. 1910.

[50] Overton. Beobachtungen und Versuche über das Auftreten von rothem Zellsaft bei Pflanzen. Jahrb. Wiss. Botan. **33**: 171. 1899.

[51] Tswett. Ueber den Pigmente der Herbstlich-vergilbten Laubes. Ber. Bot. Gesell. **26a**: 98. 1908.

clusion that the beautiful autumn colors of leaves are due to this same process, when the slowing up of the metabolic processes of the plant by the frost tends to hasten the formation of the oxidized pigments. It should be noted that in many cases the tannins act in this manner when oxidized, after being set free from their glucoside form. In a very recent study of the rôle of the glucosides in the plant, Weevers[52] concludes that these substances may be considered as reserve foods, the cyclic compounds being attached to glucose-yielding substances of low diffusibility, thus serving to accumulate sugar, etc., for future use.

Besides this coördinated action of the hydrolytic and oxidizing enzymes just described, there also seems to be an antagonistic action between the oxidases and the reducing substances in the cell; this antagonism tending to keep each sort from getting the upper hand during life, but after death when the production of reducing substances ceases for a time, the oxidases run riot, and blackening as well as colorations of various sorts result. The blackening of the foliage of many plants after a frost, and the production of the red and gold of our autumn forests, are doubtless due to the killing of the leaves or to an interference with their metabolism by the low temperature, and consequent excessive activity of the oxidases upon tannins and other substances.

Finally, Czapek[53] has brought to light a most interesting example of the part played by oxidases in the life of the plant. He found that geotropically and phototropically stimulated plant organs always contained more reducing substances and also showed weaker tests for oxidases than similar organs unstimulated. Later he proved that the reducing substance which accumulated after stimulation was homogentisic acid, and that, after stimulation, it did not seem to be destroyed by the oxidases as it had been before. What caused this accumulation of easily

[52] Weevers. Die physiologische Bedeutung einiger Glycoside. Recueil. Trav. Bot. Néerland. **7**: 1. 1910.

[53] Czapek: (*a*) Ueber einen Befund an geotropsich gereizten Wurzeln. Ber. Bot. Gesell. **15**: 516. 1897. (*b*) Stoffwechselprocesse in der geotropisch gereizten Wurzelspitze, etc. Ber. Bot. Gesell. **20**: 464. 1902.

oxidizable substances in the stimulated plant parts? By a series of careful experiments Czapek demonstrated that there was no decrease in the *amount* of oxidases present, but that they were inhibited by some influence, this influence later proving to be an anti-enzyme. He showed that the anti-enzyme thus formed really neutralized the oxidizing enzyme in definite proportion; that it was specific for that one plant, less so for the genus and not at all for distantly related plants; that heating a mixture of anti-enzyme and enzyme to 62° destroyed the former, the latter then regaining its original activity. Czapek demonstrated also that the anti-enzyme does not exist at all in unstimulated parts of the same plants, but later is produced in them upon stimulation. This anti-enzyme has the power of inhibiting the normal oxidation of the homogentisic acid in the plant, so that after stimulation, both the homogentisic acid and the anti-enzyme make their appearance and accumulate. However, Graefe and Linsbauer[54] report that they were unable to find the increase of reducing substances in stimulated parts as claimed by Czapek.

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(*To be continued*)

CHONDROPHORA VIRGATA IN WEST FLORIDA

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Ninety-three years ago that sagacious botanist, Thomas Nuttall, proposed as a new species *Chrysocoma virgata*,* describing it at some length, and remarking that it was allied to *C. nudata* Mx., but might easily be confounded with *Solidago tenuifolia*. The locality given for it was "On the borders of swamps in New Jersey, near the sea-coast." In 1836 A. P. DeCandolle included this species and a few others in his new genus *Bigelowia*,† and cited a specimen collected "in Florida prope Savannah."

[54] Graefe and Linsbauer. Zur Kenntniss der Stoffwechseländerungen bei geotropischer Reizung. Sitzber. Wien. Akad. I. Abt. **118**: 907. 1909.

* Gen. **2**: 137. 1818.

† Prodr. **5**: 329. 1836.

About the same time specimens corresponding very well with Nuttall's description were collected in Louisiana by Hale and in Texas by Riddell and by Drummond, and these were doubtless taken into consideration by Torrey & Gray in describing the range of their "*Bigelovia nudata*,"* for they did not regard the plant in question as specifically distinct.

No such plant has since been found within sixty miles of Savannah (Georgia), or within several hundred miles of New Jersey. The Louisiana and Texas specimens are still preserved in the Torrey Herbarium, but unfortunately, as in the case of many others collected in the first half of the nineteenth century, they are accompanied by no information about where they came from other than the name of the state. The omission of all data about habitat is especially disappointing, since in this particular species its habitat is one of its most important characters, as will be shown presently.

At various times in the second half of the 19th century our plant was mentioned in floras of the northeastern and southeastern states, usually as a variety of *C. nudata*, and in the absence of any accurate information to the contrary, it was assumed to have about the same range and habitat as its better-known relative, namely, the pine-barrens of the coastal plain. In 1894 Dr. Britton substituted Rafinesque's name *Chondrophora* for DeCandolle's *Bigelowia* (which was a homonym), and the following year Prof. Greene† restored our plant to specific rank, at the same time restricting the genus *Chondrophora* to these two species, *nudata* and *virgata*.

Twenty years ago, although the fact was probably not realized at the time, *Chondrophora virgata* was as completely lost to science as *Franklinia*, *Elliottia*, *Chrysopsis pinifolia*, *Pentstemon dissectus* and *Mesadenia diversifolia*, for no botanist then living had ever seen it growing. But on Sept. 15, 1892, Dr. Charles Mohr found on the rocky banks of Little River on Lookout Mountain in DeKalb County, Alabama, about 1,600 feet above sea-level, specimens of a plant which he identified with some hesitation

*Fl. N. A. **2**: 232. 1842. See also Gray, Syn. Fl. N. A. $\mathbf{1}^2$: 141. 1884.

†Erythea **3**: 91. 1895.

as this long-lost species of Nuttall's,* and a few years later Mr. Henry Eggert collected immature specimens of the same thing in the same general region.† In the spring of 1901 Mr. T. G. Harbison found it "in shallow soil in the glades and along rocky streams" on Sand Mountain in Marshall County, Alabama;‡ and in the winter of 1905–6 I saw it in Marshall, DeKalb and Cherokee Counties,§ always on Carboniferous sandstone along streams on the plateaus, as my predecessors had found it.

Up to 1903 the only known stations for this plant (excluding those in New Jersey, Louisiana and Texas as unknown) were in the mountains of Alabama. In that year, however, I collected it on outcrops of Altamaha Grit in Tattnall and Dooly Counties in the coastal plain of Georgia,|| and in 1906 I saw it in similar situations in Washington and Coffee Counties, in the same region.¶ At each of these places some of its associates were the same as in the mountains of Alabama, although the general aspect of the surrounding country was very different.

The only known exposure of Altamaha Grit in Florida is at Rock Hill, which is about 4½ miles southeast of Chipley; and up to last fall this interesting spot does not seem to have ever been visited by a botanist.** Having heard something of this place through geological literature, I visited it on Sept. 24, 1910, to see how it compared with similar places in Georgia.

*See Bull. Torrey Club **24**: 28. 1897; Contr. U. S. Nat. Herb. **6**: 79, 771. 1901.

†I saw one of Eggert's specimens in the herbarium of the New York Botanical Garden several years ago, but it has since been misplaced or destroyed, and I do not remember the exact data on the label.

‡Biltmore Bot. Stud. **1**: 153. 1902.

§Torreya **6**: 112, 114, 115. 1906.

||See Bull. Torrey Club **32**: 168. 1905; Ann. N. Y. Acad. Sci. **17**: 42, 43, 146. 1906. These two localities have since been included in the new counties of Toombs and Crisp, respectively. In 1900 (Bull. Torrey Club **27**: 423) I inadvertently designated this species as an inhabitant of moist pine-barrens in Sumter County, Georgia; but my specimens proved to be nothing but the common *C. nudata*.

¶See Torreya **6**: 243, 244. 1906.

In the Plant World for April, 1902 (5**: 71), Mr. A. H. Curtiss reports having collected *Cheilanthes Alabamensis* "on top of a tower like rock" at Cedar Grove, a few miles south of Chipley. There happens to be a tower-like rock on one side of Rock Hill, but there are no ferns on it, and Mr. Curtiss's rock must have been of a very different sort, probably limestone

Rock Hill is one of a group of several peculiar isolated hills in the northern part of Washington County, Florida.* I would estimate its dimensions roughly as about one-fourth mile long (approximately north and south), one-eighth mile wide, and 50 feet high. Like the country for several miles in all directions, it is covered with open forests of long-leaf pine, now badly damaged by lumbermen, so that the rocks on it can be seen from a considerable distance. On its slopes there are several horizontal ledges of a pine-bark-colored rock which seems to differ from the typical Altamaha Grit of Georgia† only in being a little more sandy, and this difference is apparent only on close inspection. Like the corresponding rock in Georgia, too, it never appears on the summit of a hill, but always on slopes. (See illustration.)

It seems to be generally true that the flora of any particular habitat is richest near the center of distribution of that habitat.‡ This principle is illustrated by the vegetation of Rock Hill, which is about 100 miles from any other known outcrop of the same kind of rock. On the bare rocks, and on the thin soil which covers them on gentle slopes, I identified the following species (which are here arranged approximately in order of abundance):

TREES

Pinus palustris	Quercus geminata

SHRUBS

Gaylussacia dumosa	Batodendron arboreum
Vaccinium nitidum	Callicarpa americana
Chrysobalanus oblongifolius	Serenoa serrulata
Symplocos tinctoria	

HERBS

Aristida stricta	Pteris aquilina
Chondrophora virgata	Aster sp.§
Chrotonopsis spinosa?	Laciniaria gracilis
Panicum dichotomum?‖	Campulosus aromaticus

*See Tenth Census U. S. **6**: 224. 1884.

†See Bull. Torrey Club **32**: 134–144. 1905; Ann. N. Y. Acad. Sci. **17**: 22–23. 1906.

‡See Bull. Torrey Club **32**: 149 (second paragraph). 1905; Ann. N. Y. Acad. Sci. **17**: 55, 78, 89. 1906; Torreya **7**: 43, 44. 1907.

§One of the dichotomous panicums, at any rate. In July, 1906, I saw what is probably the same thing on an outcrop of the same kind of rock in Washington County, Georgia.

‖With rather large blue heads and narrow leaves.

Fimbristylis puberula
Fimbristylis laxa
Gerardia filifolia?
Afzelia cassioides
Muhlenbergia expansa
Anthaenantia villosa
Trilisa odoratissima
Chaptalia tomentosa
Agave (Manfreda) virginica

LICHENS
Cladonia sp.

Nearly all of these plants are common in ordinary dry pine-barrens in the neighborhood, the only ones especially characteristic of the rocks being the *Chondrophora*, *Crotonopsis*, *Fimbristylis laxa*, and perhaps the *Panicum* and *Agave*.

Next to the wire-grass, our *Chondrophora* seemed to be the most abundant plant. It was in bloom at the time, and I secured plenty of specimens, which agree with those from Georgia and Alabama in every particular.

In some places on the slopes of Rock Hill a little water seeps out, making a suitable habitat for a moist pine-barren flora, of the kind that is characteristic of Southeast Georgia, West Florida, etc. One of the commonest plants in such habitats, from North Carolina to Mississippi, is *Chondrophora nudata*. Here at Rock Hill, as well as in Crisp County, Georgia,* it could sometimes be found within a few feet of its rock-loving relative; and there being no marked difference between them except in the width and number of their basal leaves, they could hardly be distinguished a few feet away.

This suggests an interesting problem in evolution. If *Chondrophora virgata* were known only from the two localities last mentioned, one might reasonably assume that it was merely a narrow-leaved extreme of the common *C. nudata*, developed in direct response to its rocky habitat. But the fact that it is most abundant in the mountains of Alabama, far removed from any *C. nudata* (which is strictly confined to the coastal plain, and does not even approach the fall-line very closely, as far as known), would seem to make this hypothesis untenable. For all we know, our plant may have been growing on the Carboniferous sandstones long before the coastal plain—or the pine-barren

*See Bull. Torrey Club **32**: 168. 1905. What is now Crisp County was then included in Dooly.

portions of it at least—emerged from the sea. An alternative hypothesis would be that *C. nudata* was evolved from *C. virgata* at a comparatively recent period, geologically speaking, and being in some manner adapted to a widespread habitat became widely

FIG. 1. Ledge of Altamaha Grit on west side of Rock Hill, Florida. *Chondrophora virgata* is common on top of these rocks.

distributed. This however does not account for the remarkably disjointed distribution of *C. virgata*, unless we ascribe to it extraordinary facilities for dissemination. Evidently there are some unknown historical factors still to be taken into consideration.

The known distribution of *Chondrophora virgata* may now be summed up by saying that it is known from three counties in the mountains of Alabama, four in the coastal plain of Georgia, and one in West Florida, always on non-calcareous rocks. (I have seen it myself in all these eight counties, and have collected it in half of them.) The re-discovery of the long-lost stations in Louisiana and Texas is greatly to be desired, especially in view of the fastidiousness of this plant as to habitat. It would appear

from statements in geological literature that a rock similar to the Altamaha Grit occurs in several places in Louisiana (possibly also in Texas), and it is in just such places that the plant should be sought.

Its eastern limit may be placed at the Ohoopee River in Georgia, at least until the mystery of the type-locality is solved. Now it happens that Nuttall was in all probability the first botanist who ever saw an outcrop of Altamaha Grit;* and knowing this, one might jump to the conclusion that he really found the plant in Georgia, and ascribed it to New Jersey through a mixture of labels or an error of his printers. But unfortunately for this theory, the supposed date of his exploration of the Altamaha Grit country is several years subsequent to the publication of his "Genera"; although it would appear from statements in this book (1: 231, for instance) that he had already visited Augusta and Savannah.

University, Alabama.

NEWS ITEMS

The old house in which Asa Gray lived for forty years, in the botanic garden of Harvard University, is to be taken down to avoid the danger from fire to the adjacent Gray Herbarium. This building, for many years the home of the university herbarium and of Dr. Gray's collections, is to be rebuilt elsewhere without much change in its form.

Dr. and Mrs. N. L. Britton have returned from a collecting trip to Cuba where explorations have been carried on in connection with the studies on the West Indian flora. Most of the collections were made in the western end of the island.

Mr. Lowell M. Palmer has given the Brooklyn Botanic Garden a collection of evergreens consisting of over five hundred plants. Many of these are rare forms in cultivation and their acquirement through the generosity of Mr. Palmer, will materially increase the beauty and educational value of the new garden's collections.

*See Torreya **4**: 138–141. 1904.

Dr. Marie C. Stopes, lecturer on paleobotany in the University of Manchester, and Dr. R. R. Gates, of the Missouri Botanical Garden, were married on March 18 in Montreal.

The biological laboratory at Woods Hole, Massachusetts, are offering the usual number of courses in botany and related subjects for the coming summer session.

At a meeting of the section of biology of the New York Academy of Sciences Prof. C. Stuart Gager recently exhibited photographs of an abnormal plant of *Onagra biennis* that appeared in a pedigreed culture, following exposure to radium rays of the ovule employed in producing the plant. The plant possessed two primary shoot-systems (rosettes and subsequent cauline stems) of equivalent value, but manifesting entirely unlike morphological characters. That the effect was due to the exposure to radium rays was held to be possible, though not conclusively shown. The antecedent history of the plant, and the fact that hybrids between the two unlike halves manifested the characters of only one of the parent shoots, was interpreted to emphasize the fact, already recognized, that the inheritance of a character and its expression are two quite different phenomena. This paper will appear in full in a forthcoming number of the BULLETIN.

Dr. R. M. Harper, whose monograph on the peat formations of Florida has lately appeared, spent several weeks consulting the collections at the New York Botanical Garden. His present address is University, Alabama.

A meeting of men interested in the advancement of biological teaching in secondary schools was held at the Harvard Union, Cambridge, February 4. The relation of school biology to civics, the sequence of laboratory experiments, outdoor work with classes, and college requirements were the topics informally discussed. Those present were Professor G. H. Parker (Harvard University), Principal Irving O. Palmer (Newton Technical High School), Dr. H. R. Linville (Jamaica High School), R. H. Howe, Jr. (Middlesex School), Samuel F. Tower (Boston English High School), S. Warren Sturgis (Groton School), Head Master Frank E. Lane and W. L. W. Field (Milton Academy, Milton,

Mass.). The last named was authorized to communicate with other teachers with a view to establishing a series of conferences, to be held probably alternately in Boston and New York.

Mr. J. J. Levison will deliver the fourth in a series of six lectures on the Cultivation and Preservation of Trees, on April 20, in the Brooklyn Academy of Music Lecture Hall. The special topic of the evening will be "Selection and Grouping of Trees for Streets, Parks and Lawns," and it will be illustrated by lantern photographs.

The alfalfa weevil introduced into this country six or seven years ago is spreading rather rapidly in the northwestern states. The damage in Utah last year is estimated at half a million dollars. Prevention seems impossible, owing chiefly to the adult habit of hiding in hay and similar commerical articles; twenty-seven were taken from the vestibule of one sleeping car at Salt Lake City last summer.

Mrs. H. L. Britton, the mother of Dr. N. L. Britton, director of the New York Botanical Garden, died April 7 at Venice.

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THE NATURE AND FUNCTION OF THE PLANT OXIDASES

By Ernest D. Clark

(*Continued from April Torreya*)

Pathology

In most of the cases first considered, the oxidases played a beneficial or useful part in the activities of plant life, but we are now to see that under certain conditions they may cause pathological processes. There is a disease of tobacco known as the "mosaic disease" which is characterized by the checkered appearance of the green leaves, these checkered places being yellow. In 1902, Woods[55] showed that rapid growth caused by cutting back often induced this disease, which he attributed to the abnormal activity of the oxidases. He believed the trouble was caused by an excessive activity of these enzymes due to lack of nitrogenous and other foods in the cells, which if present in normal quantities, seem to enable the cells to keep the oxidases within bounds. The diseased portions of the leaves showed the presence of great quantities of oxidases, but exhibited a striking lack of starch, nitrogenous matter, etc. In the so-called "mulberry dwarf" disease of the mulberry tree in Japan, Suzuki[56] found the same state of affairs. When the mulberry trees were repeatedly cut back, they developed a wrinkled and yellow appearance of the leaves, accompanied by a great increase of oxidases in the yellow portions, and also by a lack of plant foods in the diseased places. Suzuki thought that anything inter-

[55] Woods. Observations on the Mosaic Disease of Tobacco. Bull. 18, Bur. Plant Industry, U. S. Dept. Agric. 1902.

[56] Suzuki. Mulberry Dwarf Troubles in Japan. Bull. Agric. Coll. Tokyo, 4: 167 and 267. 1900.

[No. 4, Vol. 11, of Torreya, comprising pp. 77–100, was issued 19 April 1911.]

fering with the proper translocation of foods to rapidly growing parts would permit an abnormal development of oxidases and a consequent yellow or diseased condition. Woods[57] discovered that oxidases, when acting in the sunlight, have the power to destroy chlorophyll and cause yellow spots on leaves; a condition noted on the foliage of the Bermuda lily, carnation, tomato, etc. Punctures of leaves by insects or the presence of parasitic fungi, most of which contain oxidases, result in the decomposition of chlorophyll and the production of such yellow spots. Oxidases may exist in the soil or plant remains for several months, and thus cause infection if the new plants are not in a healthy condition. Recently Hasselbring and Alsberg[58] found that there is a disease of cabbage and spinach somewhat like the "mosaic disease" of tobacco. They also noted an apparent increase of oxidase content in the diseased spots, but thought this result might be caused by a decrease of anti-oxidases in the affected area.

Experimental Part

The historical part of this paper makes it evident that there has been no lack of effort to determine the distribution and nature of the oxidizing enzymes. However, many previous investigations were carried out with the use of but one reagent, which was generally guaiac tincture; besides, adequate checks upon the reagents or upon the plant juices were not made. Any one familiar with the use of the oxidase reagents realizes that the most sensitive of them, such as the indo-phenol reagent and phenolphthalin, are so easily oxidized that constant care must be taken that the action of atmospheric oxygen be not interpreted as a positive test for a weak oxidase. Furthermore, in all investigations involving the use or comparison of colors, one must be alert to detect differences due to a personal factor or to the illumination. Our investigation was undertaken with the purpose of examining and extending previous work upon the distribution of the oxidases; studying the conditions of their activity, and their effects upon different reagents, etc.

[57] Woods. The Destruction of Chlorophyll by the Oxidizing Enzymes. Centralblt. f. Bakt. II Abt. **5**: 745. 1899.

[58] Hasselbring and Alsberg, *loc. cit.*

The Nature of the Investigation

The object of our experiments may be formally stated as follows:

(*a*) To study the distribution of the oxidases and of catalase in the higher plants, beginning with the lowest; using representatives of as many available orders and families as possible. To make the data more systematic and to reveal, if possible, any natural relationships, the results are tabulated according to the botanical classification.[59]

(*b*) To examine as many plant parts as possible, to see if there is a localization of the oxidases in special organs.

(*c*) To use a series of different oxidase reagents upon each sample, and to repeat all tests, under parallel conditions, with boiled controls in every case. Our purpose in this was to detect any differences in the behavior of the several reagents when used under controlled conditions upon a large number of materials of plant origin.

(*d*) To determine the extent of the distribution of those chromogens in plants which are oxidized to colored compounds by the natural oxidase of the plant itself. These chromogens are the so-called "respiration pigments" of Palladin.

The Methods of the Investigation

The method of preparing the enzyme solution varied with the nature of the material. Fleshy parts that were sufficiently large were run through a meat-chopper, smaller ones were grated on a vegetable grater, while leaves, flowers, etc., were macerated in a mortar. Control experiments proved that the iron of the grater had no effect. In whatever manner the material was finely divided, it was then treated with distilled water and allowed to stand for fifteen minutes. The volume of distilled water varied with the amount and nature of the material. After standing for fifteen minutes with distilled water, the extract

[59] For full details of experimental work and for the arrangement of results according to the botanical classification see the original dissertation upon which this paper is based.

thus obtained was filtered through muslin.[60] These clear solutions were made up to 50, 100 or 200 cubic-centimeters, depending upon the amount of material used in the preparation of the extracts.

The tests were carried out in the following manner: 5 c.c. of the plant extract were placed in each of a series of test-tubes and to each such portion of extract ten drops of reagent were added from a dropping bottle. This was a test for the *oxygenases* (direct oxidases) and was repeated in every detail, except for the addition of five drops of 1 per cent. pure hydrogen peroxide solution,[61] when testing for peroxidase. The latter treatment caused an increase of coloration, when compared with the corresponding oxygenase effects, if *peroxidase* were present. Boiled portions of the enzyme solutions were tested in precisely the same manner for control purposes. Portions of the extracts were tested again after standing one hour, and once more after the lapse of twenty-four hours, to reveal any subsequent change in the action of the oxidases. The presence of *catalase* was shown by the evolution of gas when five drops of 1 per cent. hydrogen peroxide solution were added. Any change of color indicating chromogens or any peculiar appearance of the plant juices were noted.

It became evident very early in our work that failure to obtain a positive test for oxidases usually indicated the presence of acids; so we determined the acidity of many of the extracts by titrating ten cubic-centimeter portions with $N/10$ potassium hydroxide solution, using phenolphthalein as the indicator. To serve as a further check on our results, all of these tests were made on *another* day with *another* sample of the material to obviate the effects of any psychological differences on the observer's part, or individual variations in the plants examined.

[60] This muslin had previously been treated with boiling dilute hydrochloric acid solution. It was then washed with water, treated with boiling dilute ammonium hydroxid solution, washed with distilled water until neutral, and finally dried in a dust-free place.

[61] The best hydrogen peroxide is the "Perhydrol" of Merck, containing 30 per cent. of H_2O_2. It was diluted with twenty-nine volumes of water. This product is practically neutral and contains no preservative.

Naturally, the collection and recording of all these data pertaining to over a hundred separate plants and plant parts was no mean task, and to facilitate the process as much as possible we had mimeographed sheets prepared with appropriate columns so that the labor of recording and preserving many hundreds of observations was reduced to a minimum.

As reagents for the oxidases, we used ordinary *guaiac tincture*, also tincture of guaiacum which had been boiled with bone-black to remove peroxides,[62] α-naphthol, the hydrochloride of para-phenylene-diamine, phenolphthalin, the indo-phenol reagent and phenol. Both the ordinary and purified guaiac tinctures were 2 per cent. solutions of gum guaiacum in absolute alcohol. These tinctures give a blue color when oxidized.

The *α-naphthol reagent* had a concentration of 1 per cent. of the substance in a 50 per cent. aqueous solution of alcohol. It gives a lavender color when oxidized.

The *para-phenylene-diamine* solution contained 1 per cent. of the hydrochloride in distilled water. This reagent yields a greenish color when oxidized.

The *phenolphthalin reagent* was made according to Kastle's method.[63] We treated a pinch of phenolphthalin with 1 c.c. of N/10 NaOH solution, dissolved as much of it as possible, then added 25 c.c. of water, filtered and made up to 100 c.c. We used 5 c.c. of this solution plus 10 c.c. of the extract to be tested for the oxidase, let the mixture stand fifteen minutes, then made it alkaline with N/20 NaOH solution, when the mixture, in the presence of oxidases, acquired a pink or red color due to the phenolphthalein resulting from the oxidation of the colorless phenolphthalin.

The *indo-phenol reagent* was applied by adding two or three drops of a 1 per cent. solution of α-naphthol in 50 per cent. alcohol and an equal amount of a 1 per cent. aqueous solution of para-phenylene-diamine hydrochloride to the extract to be tested, then making the mixture slightly alkaline with sodium

[62] Moore and Whitley. The Properties and Classification of the Oxidizing Enzymes, etc. Biochem. Jour. 4: 136. 1909.

[63] Kastle, Chemical Tests for Blood. Bull. 51, Hyg. Lab'y, U. S. Pub. Health and Marine Hospital Service, Washington, 1909, p. 25 ff.

carbonate solution, which caused the purple oxidation product to dissolve.

Phenol was used in a 5 per cent. aqueous solution and became reddish brown in twenty-four hours if oxidized.

The phenolphthalin and indo-phenol reagents oxidize spontaneously in the air and must be freshly prepared for satisfactory use.

In testing for the chromogens in the various plants we merely allowed some of the juice to stand for twenty-four hours, when the chromogens became evident by being changed by the oxidases to the colored state, generally brown, reddish or black.

For the detection of oxidases in plant sections, under the microscope, one may use the α-naphthol reagent described above, either with or without hydrogen peroxide. Under these conditions oxidizing tissues or cells soon stain violet or lavender and make a beautiful picture until the diffusion of the oxidases is complete and the whole preparation becomes dark. Sections of vines containing much food-conducting tissue, such as *Aristolochia macrophylla*, stain very strikingly as a result of this treatment.

SUMMARY OF OXIDASE TESTS

Specimens Examined	Oxygenase	Peroxidase	Catalase	Chromogens
All parts (110)	**55**	**78**	**105**	**30**
Leaves (17)	12	12	16	6
Floral organs (20)	8	11	20	7
Tubers, bulbs, etc. (21)	14	20	19	7
Fruit (41)	13	28	40	7
Other parts (11)	8	7	10	3

Study of the Effect of Acidity upon Oxidases

In the course of our systematic search for the oxidases, it soon became evident that an acidity in the plant juices and extracts greater, per 10 c.c. of plant liquid, than the alkalinity of 0.8 c.c. of N/10 KOH solution, with phenolphthalein as the indicator, usually indicated the absence of oxidases in the plant part under examination. These observations led the writer to study this phenomenon further. It was found that 10 c.c. of lemon juice required 18.5 c.c. of N/10 KOH solution for neutralization, and did not show the presence of oxidases either before or after neutraliza-

tion. Three or four drops of a coffee-bean extract showing a very high oxidase activity were added to 10 c.c. of fresh lemon juice, with the result that the oxidase action was inhibited, but immediately after neutralization the oxidase caused a faintly positive test. This same experiment was repeated, using 9.25 c.c. of N/5 acetic acid solution, the N/5 solution being used to make the total acidity equal to that of the lemon juice and to keep the total volume always the same (10 c.c.), with the addition of distilled water and a few drops of coffee-bean extract as before. To our surprise this apparently did not affect the oxidase at all, for a very strong coloration was obtained with guaiac tincture, etc. Then the experiment was repeated in exactly the same manner upon mixtures containing 9.25 c.c. of N/5 H_2SO_4, HCl, and citric acid solutions. The results were the same in the three cases: the oxidase reaction was completely inhibited and after neutralization with calcium carbonate or potassium hydroxid, a faint bluish coloration of guaiacum was detected in the citric acid test-tube. The rest were negative after neutralization. The sulphuric acid mixture was neutralized with calcium carbonate and divided into two portions, to one of which fresh coffee extract was added, to the other some fresh guaiac tincture; no bluing was produced in either case, nor was it obtained in several repetitions of the experiment.

To determine more exactly the influence of different acids upon the bluing of guaiacum by the oxidase of the coffee-bean, a series of experiments were made in the manner already described. In all cases the results obtained were consistent and showed the inhibiting effect was traceable to the activity of the hydrogen ions from the acids in aqueous solution. We conclude, therefore, that the failure to find oxidases in most plant juices, when the acidity is greater per 10 c.c. than that equal to the alkalinity of 0.6 to 0.8 c.c. of N/10 KOH solution, is due to the effect of the different acids upon the peroxidases, etc., and this influence is probably not specific for the acids, but depends upon their dissociation and consequent yield of hydrogen ions. In the following table we indicate the known comparative accelerating effects of these common acids upon the inversion of sucrose,

and their relative retarding effects upon the oxidase tests. The names are arranged in the order of the corresponding activities:

Acceleration of Sucrose Inversion	Retardation of Oxidase Test
HCl (greatest)	HCl (greatest)
H_2SO_4	H_2SO_4
Citric acid	Citric acid
Acetic acid	Acetic acid.

Summary of General Conclusions

1. The oxidases are of very wide distribution among the flowering plants; peroxidases, especially, being present in about seventy-five per cent. of all the specimens examined, while oxygenases (direct oxidases) are less widely distributed, being found in one-half of the plants used. Catalase may be said to be universally distributed, since there were only a few cases in which it was not found.

2. The leaves, stems, roots and food-storage organs of the plants seemed to contain the greatest amounts of the oxidases. The flowers and fruit were in many cases comparatively poor in oxidases. In regard to the fruits this statement must be qualified because dry seeds of somewhat uncertain age were the only available material of certain species.

3. Our experience with a great many parallel tests, using the different oxidase reagents upon a great variety of vegetable tissues show that all of the reagents seem to detect the same substance or substances, for if one reagent gave a positive test the others generally acted in like manner. The phenolphthalin and indo-phenol reagents gave positive results in more cases than the others. This is undoubtedly due to their greater ease of oxidation, for they are spontaneously oxidized by the air.

4. It is probable that in the presence of acid juices in the plant the latter does not form oxidases or else that they are immediately destroyed by the acid. It was shown that the inhibiting effect of acids upon the action of oxidases seemed to be a function of the concentration of the hydrogen ions.

5. Among plants the chromogens are found to the greatest extent in certain orders such as the Liliales, Orchidales, Ranales, and most frequently of all in the latex plants of the Convol-

vulaceae, Boraginaceae, Labiatae, Solanaceae, Rubiaceae, Compositae, etc. Active oxidases are also likely to be associated with chromogens in the latex plants. These conclusions are interesting because of the bearing they have upon Palladin's theory that these chromogens play an important part in the respiration and the metabolism of plants.

The writer wishes to express his deep indebtedness to Professor William J. Gies for suggesting the nature of this investigation and for the aid received from him during its course. The sincere thanks of the writer are likewise due to Doctor N. L. Britton of the New York Botanical Garden, for material obtained from the Conservatories, and also for the other privileges of the institution.

Supplementary Bibliography of Papers Recently Published

Bailey. Oxidizing enzymes and their relation to "sap-stain" in lumber. Bot. Gaz. **50**: 142. 1910.

Bassett and Thompson. The preparation and properties of an oxidase occurring in fruits. Jour. Am. Chem. Soc. **33**: 416. 1911.

Battelli and Stern. Recherche sur la fonction de la catalase. Compt. Rend. Soc. Biol. **68**: 811. 1910.

Bertrand and Rosenblatt. Sur la temperature mortelle des tyrosinases végétales. Compt. Rend. Acad. Sci. **150**: 1142. 1910.

Betting. Oxidase and peroxidase in tobacco. Reviewed in Chem. Abstracts **5**: 740. 1911.

Combes. Du role de l'oxygene dans la formation et la destruction des pigments rouges anthocyaniques chez les végétaux. Compt. Rend. Acad. Sci. **150**: 1186. 1910.

Dox. Catalase of molds. Jour. Am. Chem. Soc. **32**: 1357. 1910.

Gramenisky. Ueber die Widerstandfähigkeit der Oxydasen. Reviewed in Zentralblt. f. Biochem. u. Biophysik. **1**: 606. 1910.

Harter. Starch content of leaves dropped in autumn. Plant World **13**: 144. 1910.

Hoffman and **Sokolowski.** Vergleichenden Atmungsversuche mit verschiedenen Kartoffelsorten. Zeitsch. f. Spiritusindustrie **33**: 391. 1910.

Huber. Ueber die Lebensdauer der Oxydationsenzyme in der Birnenfrüchte. Schweiz. Wochensch. f. Chem. u. Pharm. **48**: 393. 1910.

Kostytschew. Ein eigentümlicher Typus der Pflanzenatmung. Zeitsch. f. Physiol. Chem. **65**: 350. 1910. See also Zeitsch. f. Physiol. Chem. **67**: 116. 1910.

Nalli. Sulla sede intracellulare del fermento ossidante. Clinico Med. Ital. **48**: 24. 1909.

Palladin. Synergin das Prochromogen der Atmungspigmente der Weizenkeime. Biochem. Zeitsch. **27**: 442. 1910.

——. Ueber die Wirkung von Giften auf die Atmung lebender und abgetöteten Pflanzen, sowie auf Atmungsenzmye. Jahrbuch f. Wiss. Bot. **49**: 431. 1910.

—— and **Stanewitsch.** Die Abhängigkeit der Pflanzenatmung von Lipoiden. Biochem. Zeitsch. **26**: 351. 1910.

Rosenberg. Ueber die Rolle der Katalase in den Pflanzen. Ber. Bot. Gesell. **28**: 280. 1910.

Schreiner. Reduction by Roots. Bot. Gaz. **51**: 121. 1911.

—— and **Sullivan.** Studies in soil oxidation. Bull. 73, Bureau of Soils, U. S. Dept. of Agriculture. Washington, 1911.

Sée. Les diastases oxydants et réductrices des champignons. 1–39. Paris, 1910.

Sjollema. Ueber die Bedeutung kolloider Manganoxydlösungen bei biochemischen Oxydationen. Reviewed in Chem. Zentralblt. 1911, 1, p. 496.

Wolff. Action des phosphates alcalins bibasiques sur la tyrosinase. Compt. Rend. Acad. Sci. **150**: 477. 1910.

——. Contribution à la connaissance de divers phénomènes oxydasiques naturels et artificiels, 1–99. Paris, 1910.

Zaleski. Ueber die Rolle der Reduktionsprozesse bei der Atmung der Pflanzen. Ber. Bot. Gesell. **28**: 319. 1910.

—— and **Reinard.** Zur Frage der Wirkung der Salze auf die Atmungsenzyme. Biochem. Zeitsch. **27**: 450. 1910.

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SOME FLORAL FEATURES OF MEXICO*

By H. H. Rusby

(*Continued from April Torreya*)

One of the most beautiful spots that I have ever visited is that of the lava beds a few miles south of Mexico City, on the railroad leading to Cuernavaca. This has been one of the favor-

ite collecting grounds of our Mr. Pringle, for which reason alone it should always possess a deep interest for American botanists. As I remember, Cuernavaca is distant from the City of Mexico in a straight line only about fifteen miles, but, since the train has to pass over a summit more than ten thousand feet in height, about three thousand feet higher than Mexico, we travel some fifty miles in reaching it. The mountain thus traversed consists of the roughest kind of lava formation, full of deep gullies and ravines which are bordered by rugged and often overhanging walls, with sharp pockets, sometimes caves, and innumerable abrupt and jagged projections. Were this surface to be viewed with its vegetation wholly removed, it would appear as though the growth of ordinary vegetation upon it was almost impossible, yet it bears a flora of the richest character and greatest interest, and one that is varied in every sense of the term. Much of its surface is covered with a fine forest of good sized pines, with some cypress and other coniferous evergreens. At places this gives way to arborescent *Arctostaphylos*, with many oaks. Its shrubs grow densely and represent so many families and genera that from a systemic point of view this growth is scarcely characteristic. It is, however, the herbaceous growth which is most varied and interesting. If everything but the ferns were removed the appearance would still be that of an abundant vegetation. Taking only five or six good specimens of each species, I could have loaded my portfolio within an area of a hundred yards square. This is the natural home of the dahlia and one is bewildered by the variety which it displays. It is impossible to say whether the different forms are mere variations, or hybrids, or numerous closely related species. Acres are covered with them and they are often from six to eight feet in height. They are for the most part of very slender habit. Pentstemons, lamourouxias and other scarlet-flowered figworts are very conspicuous. Verbenas are abundant and varied, as are castilleias, and there are dazzling golden patches of composites lying flat upon the ground. Beautiful asters and flea-banes abound. The cool, damp, open places at the higher altitudes are densely carpeted with a free blooming, large-flowered *Stellaria*. Upon

the summit of this range there is a kind of table land which for many miles forms an open prairie. The predominent grass grows in very large and high bogs or hummocks in the rich black soil. The roots of this grass are shipped by train loads to Germany, it is said for the manufacture of some sort of a brush or broom. Abruptly descending upon the southern side of this range, we cross a broad cultivated valley or plain and there follow

FIG. 4. The Great Oaxaca Canyon.

a river through a deep canyon which traverses a range which appears of even greater height than that previously crossed. Upon the other side we continue down this river valley until it empties into the Balsas, at the town of Balsas, which is the end of the railroad line. I made no stop in this second range but it was very evident that its flora is totally distinct from that of the Cuernavaca Mountains. At Balsas we are distant about fifty miles from the Pacific, though as the river runs, the distance is much geater. We are in the midst of a multitude of gigantic mountains, which continues without interruption almost to the ocean's edge. Except in the immediate vicinity of the streams this mountain region is very arid. The rainy season is of short duration and the rains are usually not at all copious. The ground therefore has but a slight permanent supply of moisture,

springs are scarce, and the vegetation dries up with surprising quickness at the close of the rainy season. Nevertheless, while the season lasts, this vegetation is fairly abundant and varied. It is, moreover, rather peculiar to the region, therefore of special interest. Not only the herbaceous vegetation, but the shrubs and trees, are of strange relationship. Among the smaller trees, an extremely poisonous species of *Rhus* is perhaps most noticeable. Near the water the alligator pear grows spontaneously and reaches a rather large size. The canyons and gulches are full of beautiful white-flowered or violet-tinted acacias. A small arborescent *Malpighia*, with edible fruit, is abundant. The ground is covered in many places with gorgeous *Tribulus*,

Fig. 5. Balsas Mountains, Guerrero.

in others with *Ruellia*, and very often with some plant related to *Allionia*, but with handsome rose-purple flowers as large as ordinary morning-glories. Many Asclepiadaceous vines twine among the shrubbery. The *Echinocacti* are of peculiar type, scarcely projecting above the ground and crowned with woolly tufts.

I twice visited Limon Mountain, about four miles from the town of Balsas, and the crowning peak of the region. Its sides are extremely steep and for the most part densely clothed with

small trees and shrubs, Mimosaceae predominating. One of these small trees is a *Clerodendron*, or ally thereof, with very showy flowers. Another tree is a beautiful new species of *Hauya*. A new species of *Linociera* bore excellent edible fruit. The open spaces were clothed with composites and shrubby heliotropes and a graceful bamboo grows freely. *Vitis blanco* is a very peculiar grape, with massive but inedible fruit. Upon the rich shaded banks beautiful *Achimenes* intermingle with a plant related to *Tradescantia*, its broad fleshy leaves lying flat upon the ground and beautifully variegated with purple and several shades of green. Here grew upon the rocks, in sunny places, a peculiar *Opuntia*, unlike any that I have seen elsewhere, and about the edges of cliffs were robust growths of *Plumiera*. Quite a collection of plants was obtained upon this mountain but I have found no opportunity of studying them.

Returning to Mexico City, and traveling thence *via* Puebla, we pass down into the state of Oaxaca, a region which is really a continuation of the Balsas district, though farther south and correspondingly hotter. Its conditions of aridity are about the same as those of Balsas. Like Balsas, too, it possesses a formidable mountain range. In the highlands about Puebla, we are surprised to see the otherwise bare ground densely carpeted with a bright rusty yellow *Cuscuta*. It probably lives upon grass rhizomes.

Approaching Oaxaca, we pass for many miles through one of the greatest of mountain canyons, in some places approaching in depth and grandeur our Grand Canyon of the Colorado. Some of the summits in the vicinity of this canyon are said to be almost inaccessible, while others can be scaled only on foot and by a few circuitous routes. Several days were spent in this canyon. My special work was laborious and exacting, but I managed to snatch a collection of nearly a hundred species. These and the very many that I saw without being able to collect them, have left me with an intense desire to spend some time in that region. The proper time to collect here is from late June to September. In the bottoms of the canyons and along the sides of the shaded ravines, where one can traverse them, he finds a

profusion of strange forms and many exceedingly beautiful ones. When he succeeds in passing over and among the mountain tops he finds forests of oak, mingled with a great variety of other trees and thickly clothed with epithytes, including many orchids, ferns and bromeliads. Wherever he encounters a little stream or some boggy ground, there is a world of little things which add

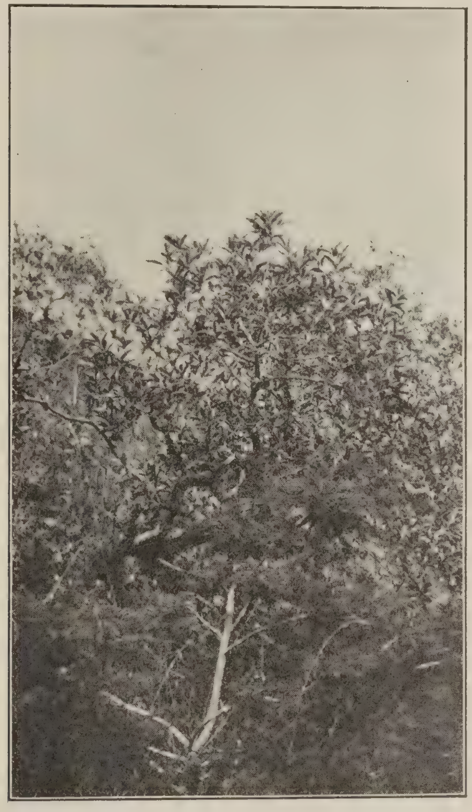

FIG. 6. *Byrsonima Karwinskiana.*

a peculiar charm to the day's study. Along the larger streams we see many trees at whose affinities we can hardly guess. One of them is heavily clothed at the ends of the branchlets with tufts of thick, shining linear leaves resembling in outline and size the fruits of the catalpa, and having dense masses of fruits resembling

small, unopened cotton bolls. The shrubbery in the river bottom is completely covered with what we take to be wild grape vine but which proves to be a broad-leaved bignoniad. Among the lower hills we find a dense growth of horrible *Jatropha* shrubs and tangled among their bases a peculiar *Pedilanthus*. Plumieras are also abundant and like the two last-named are capable of yielding some rubber. Every bank is gay with *Tribulus* and Nyctaginaceae. Asclepiadaceous vines and ipomeas are every-

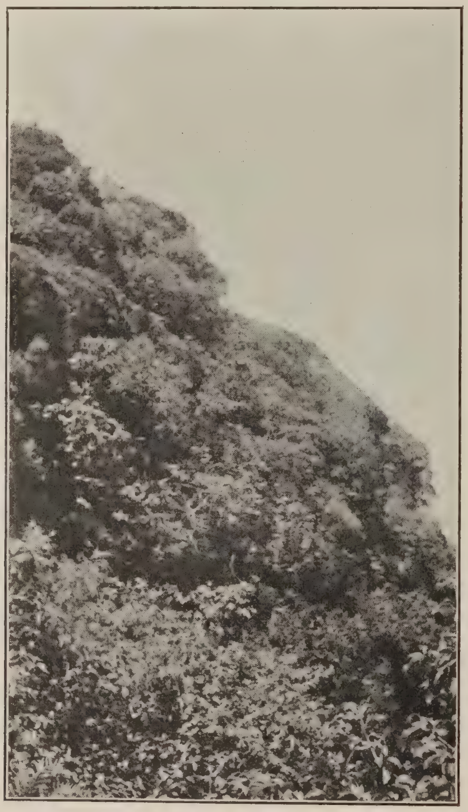

FIG. 7. Near the summit of Limon Mountain, Guerrero.

where. In one of the gulches I found an undescribed species of mulberry.

The plains and lower hills of this valley are almost exclusively

occupied by a cactaceous growth. Although there are many Opuntias, the predominant forms are of the giant *Cereus* type. The most conspicuous and truly gigantic of them is locally known as "cardon" and is, I believe, a species of *Pachycereus*. I have seen a single tree under which, I believe, almost an entire company of mounted cavalry might gather. These species bear, for the most part, delicious edible fruits. Among the rocks on the hillsides, great numbers of mammillarias and other dwarf species are encountered.

We cannot get much farther south than Oaxaca without getting into the truly tropical vegetation of the lowlands. Indeed, we have only to cross the great mountain range south of this canyon, a distance of some fifteen miles, to find ourselves in the fever infested fens of the Tuxtepec valley.

Here of course the flora is almost totally distinct from anything that has been described. The trees are the huge giants which characterize our American tropics and the vines which bind them together are great woody climbers with trunks several inches in diameter and branches extending for hundreds of feet. A variety of palms, some of them of exceeding beauty, occupy the slopes and among them are gigantic, as well as curious and beautiful aroids and superb cycads. Huge ferns, fuchsias, begonias and oxalids occupy the ledges and steeper banks, and both terrestrial and arboreal orchids are abundant. The rivers are bordered by great *Fici*, and several species of spondias, and the swamps are filled with the peculiar Glumaceae and showy aquatics which characterize similar situations throughout our tropics. Of this tropical region, time will not permit me to speak, but I can say that, while its general character is like that of Central America, its specific characters are largely unknown.

College of Pharmacy,
New York.

PROCEEDINGS OF THE CLUB

January 25, 1911

The meeting of January 25 was held in the museum building of the New York Botanical Garden at 3:45 P.M. President Rusby occupied the chair. Twenty-two persons were present.

The minutes of the meeting of January 10 were read and approved. The name of W. W. Eggleston was proposed for membership. It was then voted to accept the resignations of Mr. S. B. Parish and Miss Louise Bruckman.

President Rusby, chairman of the committee on the "budget" for 1911, submitted a report on a special meeting held January 21.

The report was approved and the recommendation of the committee to borrow $400 from the permanent fund was adopted by unanimous vote.

The application of Norman Taylor for a grant of $200 from the Esther Herrman fund to enable him to make further investigations on the flora of the Catskill Mountains and of New Jersey was read and ordered forwarded to the Council of the New York Academy of Sciences with the unanimous approval of the club.

A communication was read annnouncing the death of Frederic Ehrenberg and the secretary was authorized to extend the sympathy of the members of the Club to the relatives of the deceased.

Dr. William Mansfield was unanimously elected delegate to the Council of the New York Academy of Sciences, and Dr. C. A. Darling and W. W. Eggleston were elected to membership in the club.

First on the announced scientific program was a discussion of "Two New Species of Edible Fruits" by Dr. H. H. Rusby.

These fruits were both from Mexico, one being *Morus mollis* Rusby, the other *Linociera macrocarpa* Rusby. Their descriptions will appear in an early number of the *Bulletin*.

The second number on the program was "Notes on Cuban Ferns" by R. C. Benedict. An abstract prepared by the speaker follows:

"Cuba promises to be especially rich in ferns. At present it is not very thoroughly explored botanically, but by comparing the number of species in certain genera now known from Cuba with the total number of species in these genera known from North America, it appears probable that eventually Cuba will prove to be as rich in ferns as Jamaica is now known to be.

"To illustrate with one genus, *Anemia* as presented in the North American Flora, Volume 16: part 1, is recognized as having twenty-six North American species, with ten in Cuba. Recent collections for the New York Botanical Garden have included material of three species not accredited to Cuba in the Flora. The list of Cuban anemias now stands: (previously recorded) *A. phyllitidis*, *A. Underwoodiana*, *A. obovata*, *A. pastinacaria*, *A. Wrightii*, *A. cicutaria*, *A. speciosa*, *A. cuneata*, *A. coriacea*, *A. adiantifolia;* (to be added) *A. nipeënsis* Benedict (new), *A. aurita* (either this or undescribed), and *A.* sp. (probably undescribed).

"Thus, Cuba now has thirteen out of twenty-eight, and in the total number, there are several species now found in neighboring islands, and which may be expected in Cuba.

"Some of the Cuban species of *Anemia* are especially interesting. For example, *A. pastinacaria* has been found in the West Indies only in Cuba, but is native also in Mexico and South America. *A. speciosa* has a somewhat similar distribution. Mrs. N. L. Britton has collected in Cuba material here identified as *A. speciosa* which exceeds Mr. Maxon's North American Flora description, in that it has leaves twice-pinnate below instead of merely pinnate.

"*Anemia nipeënsis* Benedict, was collected by Dr. J. A. Shafer in the Sierra Nipe, a hitherto botanically unexplored Cuban mountain range. The plant indentified as *Anemia aurita* is similar to small Jamaican specimens of this species but is not certainly the same."

The next number on the program was "Reviews of Recent Moss Literature," by Mrs. N. L. Britton.

Mrs. Britton gave a brief abstract of three recent publications which contain references to or descriptions of North American Mosses as follows:

"1. The mosses of Swedish-Lappland by Arnell and Jensen contains a reference to *Polytrichum gracile* var. *anomalum* with a record of its occurrence in Maine. The ecological studies and tables are of much interest and the nomenclature follows that of Lindberg's mosses of Scandinavia of 1879 and adopts the oldest specific name and the original generic name in its primitive sense.

"2. The non-European or exotic mosses by Dr. Georg Roth as a sequel to his European mosses in which an attempt is made to describe and figure all mosses from original specimens. In the first part, the genus *Andreaea* is treated, including 102 species of which 5 are North American and 28 from South America, all but 13 of these illustrations have been drawn from original material and the coöperation of many prominent bryologists and botanical institutions has been secured so that this publication will be of great value to American students.

"3. In the December number of the *Journal of Botany*, Mr. H. N. Dixon has a new genus of mosses and a contribution to the bryology of India, including some from the Mitten Herbarium. As Mr. Dixon and Monsieur Cardot are the two most prominent bryologists who have recently followed the 'Kew Rule' in the nomenclature of mosses, we welcome the statement made on page 303 that "The nomenclature of Brotherus in Engler and Prantl Pflanzenfamilien has been and will be followed hereafter in these lists."

"4. In the *Bulletin* of the Botanical Society of France, Memoir 17, Monsieur Dismier has recently published a revision of *Philonotis* of America including 8 species and 4 subspecies from North America with an extension of range northward into Florida, Louisiana and Texas of *P. gracillima*, *P. sphaerocarpa* and *P. tenella* and the description of two new subspecies *P. fallax* and *P. americana*. Stations and numbers of specimens are cited in detail and M. Dismier promises to continue the study of the genus."

Dr. W. A. Murrill then exhibited a specimen of an interesting fungus which had grown in total darkness in a mine. It was completely sterile not even having conidia. The specimen which he called *Elfvingia megaloma* showed several regions of growth corresponding to the age in years of the plant.

Dr. N. L. Britton showed several specimens of *Zamia* and Miss Pauline Kaufman exhibited several varieties of edible nuts recently appearing in the markets of New York City.

Adjourned.

B. O. Dodge,
Secretary.

February 14, 1911

The meeting of February 14, 1911, was held at the American Museum of Natural History at 8:30 P.M., with President Rusby in the chair. Eleven persons were present. The minutes of the meeting for January 25 were read and approved.

The announced paper of the evening on "Floral Features of Mexico" was then presented by Dr. H. H. Rusby and illustrated by lantern-slides. This paper appears on another page of Torreya.

Meeting adjourned.

B. O. Dodge,
Secretary.

March 14, 1911

The meeting was held at the American Museum of Natural History. The meeting was called to order by 8:15 with Dr. E. B. Southwick in the chair. Twenty-eight persons were present.

The minutes of the meeting for February 14 were read and approved. On the motion of Mr. G. V. Nash the regular order of business was dispensed with for the evening.

The scientific program consisted of a lecture on "Orchids, Wild and Cultivated," by Mr. Geo. V. Nash. The lecture was illustrated by a large number of beautiful lantern slides. An abstract of the lecture prepared by the speaker follows:

"By the general public any odd or strange flower was considered an orchid, and as an illustration of this common error nepenthes and bromeliads were cited. The large division of endogenous plants to which the orchids belong was illustrated with a slide of the lily, this being taken as typical. Especial attention was called to the stamens and pistil which are distinct in this flower. As an illustration of a typical orchid flower a slide of *Cattleya* was shown. The uniting of the stamens and pistil

into one organ, known as the column, was pointed out as the distinctive character of the orchid.

"Another interesting feature is the diversity of the lip-form. The lip is one of the petals. In some forms, such as *Odontoglossum*, it much resembles the other petals. In *Oncidium* it is markedly different in size and color; in *Cattleya* it becomes more modified by the inrolling of the base into a tube which surrounds the column; in *Dendrobium* a still greater modification occurs in the inrolling of the margins of the lip into a saccate organ; and in *Cypripedium* this tendency is greatly magnified, giving us the "slipper."

"The stem or leaves of orchids are frequently thickened, thus serving as storage organs for water. The water supply of many orchids, on account of their habitat on trees and rocks, is very uncertain, and those thickened leaves or stems carry the plants safely through periods of drought. When the thickened stems are short, and round or oval, they are known as pseudobulbs.

"Some orchids grow in the ground and are known as terrestrial. These are commonly found in temperate regions, where dangers from frost exist. The majority, however, are epiphytic, that is, they grow on trees, and are found in warm temperate and tropical regions. The number of species is between 6,000 and 7,000, of which about 150 are found in the United States. The two great centers of their occurrence are: in the New World, in northern South America, northward into Central America, and in the West Indies; in the Old World, in India and the Malay region. A series of slides was then exhibited illustrating some of the common wild and cultivated forms."

Meeting adjourned,
B. O. Dodge,
Secretary.

FIELD MEETINGS

The following excursions are advertised by the field committee:

May 13.—Edenwald, N. Y. Meet at Terminus of 3rd Avenue Elevated R. R. at Botanical Garden, at 1 P. M. Fare 20 cents. Guide, Dr. P. A. Rydberg.

May 20.—Springfield, L. I. For Orchids. Meet at East 34th Street Ferry, New York side, 1 P. M. Guide, DR. E. B. SOUTHWICK.

May 27.—Summit, N. J. Lackawanna R. R. Meet at West 23rd Street Station, at 9 A. M. Guide, MR. SERENO STETSON.

June 3d.—To Staten Island, N. Y. Guide to determine Station. Fare 20 cents. Meet at Staten Island Ferry, N. Y. side, 9 A. M. Guide, MR. B. O. DODGE.

June 10th.—To Hollis, L. I. Meet at East 34th St. Ferry, N. Y. side, 9. A. M. For study of Fungi. Guide MR. F. J. SEAVER.

June 17–21. Slide Mountain, Ulster Co. This excursion may involve camping on the summit of the mountain for two nights. All those desiring to attend please communicate with the guide MR. NORMAN TAYLOR, Central Museum, Eastern Parkway, Brooklyn, by May 30th in order that the necessary arrangements may be made.

The Field Committeee.
E. B. SOUTHWICK,
Chairman.

NEWS ITEMS

We learn from the *Tribune* (May 1) of the death of Dr. Pehr Olsson-Seffer in a train, wrecked and shot at by Mexican revolutionists. The week-end special train for Cuernavaca, seventy-five miles south of Mexico City, was stopped by the firing of a volley through it and its derailment. Dr. Olsson-Seffer, who was widely known for his work in tropical botany and agriculture, was born in Finland, went to Australia and subsequently to California where he became instructor in Stanford University. Latterly he made a tour of the tropical world to study the rubber industry, and was recently appointed to the chair of botany in the newly created Mexican University.

The following public lectures are advertised at the New York Botanical Garden, Bronx Park. They are at 4 P. M. May 20. "The Reef-building and Land-forming Seaweeds," by Dr. Marshall A. Howe. May 27. "The Influence of Soil Acidity

on Plant Distribution," by Mr. Frederick V. Coville. June 3. "How Plants are Distributed," by Prof. Carlton C. Curtis. June 10. "The Royal Gardens at Kew, England," by Dr. William A. Murrill. June 17. "Collecting in the High Mountains of Colorado," by Mr. Fred J. Seaver. June 24. "Past Climatic Conditions Indicated by Fossil Plants," by Dr. Arthur Hollick.

At an arbor day celebration in the Central Museum, Brooklyn, held on April 27, more than 1,600 school children actually heard and saw the exercises. Nearly 2,500 more, who could not be accommodated, were obliged to go home, although some of this excess crowd took part in a tree-planting in the adjacent Botanic Garden grounds.

In TORREYA for January, page 9, bottom line, the name *Panicum neuranthum* should be *Aristida stricta*.

Dr. C. B. Robinson of the Philippine Bureau of Science expects to return to this country about the end of July. Dr. Robinson was formerly an assistant curator at the New York Botanical Garden, and has been in the Philippines for the last three years, giving much of his time to fiber investigations. He is now collecting along the Indo-China coast.

According to the *New York Evening Post* a gift of $25,000 from an anonymous donor makes possible the immediate construction of a two-story addition to the Gray Herbarium building, in which the botanical library will be housed.

At the annual meeting of the Naples Table Association, held at Smith College on April 30, the table for 1911–12 was awarded to Miss Mary Edith Pinney, B.A. Kansas 1898, M.A. 1910. Miss Pinney is now studying at Bryn Mawr for her Ph.D. degree, and has just received the M. Cary Thomas European fellowship for 1911–1912.

Mr. K. F. Kellerman of the Bureau of Plant Industry sailed for Europe on April 25 to study recent progress in soil bacteriology. He will visit Germany, Russia, France and England.

Professor Eduard Zacharias, director of the Botanical Institute of Hamburg and author of numerous papers on cytology, has died.

TORREYA

June, 1911

Vol. 11 No. 6

A NOMENCLATORIAL PROBLEM WITH A DESCRIPTION OF A NEW FORM, PETALOSTEMUM PURPUREUM F. ARENARIUM*

By Frank C. Gates

Individual plants of a given species occupying different habitats may become considerably modified, giving rise to variation among themselves. This is usually conceded to be an adaptation, induced by the local habitat, in the individual plant. To a taxonomist, the resulting form is but an extreme variation from the type and no general advantage is secured in giving it a name. A specific name is inapplicable, as complete series of intergrading forms are frequently present. To an ecologist, however, the matter stands in a very different light. He is dealing primarily with plants in their habitats. The ability of a single species to live in more than one habitat may often be an important factor in determining the relationships of the vegetation.

The usual form of a species tends to grow in the preferred habitat of that species. Widely varying forms are likely to be results of associational succession. The forms are consequently given the terms relics or invaders according to their position in the genetic series of succession. The form of the relic species changes because some of the external conditions have been changed by the successful invasion of an association. The invasion of the forest upon the prairie furnishes many excellent examples through the persistence of a number of prairie species

* Contributions from the Botanical Laboratories of the University of Michigan No. 124.

Submitted with the spelling in accordance with recommendations of the Simplified Spelling Board, and changed to conform to the editorial policy of Torreya. —N. T.

[No. 5, Vol. 11, of Torreya, comprising pp. 101–124, was issued 17 May 1911.]

in spite of the unaccustomed shade. Relic species are frequently very tenacious of life and will struggle for a long time before they succumb. They are usually able to reproduce vegetatively.

The status of invaders is only a little different. The invader must be able to cope advantageously with the new conditions from the beginning, in order to maintain its life. This may induce extreme variation, which is not mutation because there are usually all stages of transition from the usual form to the new form. Furthermore, when the succeeding association becomes dominant in an area in which the extreme form originally developed, only usual forms occur. Conclusive evidence is at hand to show that the vegetative structures of a perennial plant,

FIG. 1. *Petalostemum purpureum* f. *arenarium* growing among the bunches of *Andropogon scoparius* in the bunchgrass prairie. Waukegan, Illinois.

acting as an invader, may be strikingly different from the structures of the same plant after the successful invasion of the

association, of which it is a characteristic species, takes place. This would seem to indicate that such forms are responses to environment. Consequently their distinguishing characteristics are not characters of organization. If this were not so, such forms would hold valid claims to specific rank. Such modifications occur constantly, but only occasionally are they of important ecological significance. It may happen to several, and sometimes to all, of the species growing in a certain habitat. There need be no taxonomic relationship between the species so involved.

The modifications most frequently observed tend towards the conservation of water supply. These are observed on soils made up chiefly of sand and gravel. The plants themselves are usually smaller. They are frequently more pubescent than usual. The leaves are narrower, thicker, often rolled, and frequently assume positions of protection from the noonday sun. The root system is more extensively developed, the flowers and fruit, however, do not ordinarily exhibit noticeable differences from the ordinary type. There is frequently a tendency to bloom more freely unless the growing conditions are extremely severe.

PETALOSTEMUM PURPUREUM f. **arenarium** FORMA NOVA*

	Petalostemum purpureum (Prairie plant)	*Petalostemum purpureum* f. arenarium
Root	tap root	larger and more bulky tap root
Crown	composed of a few upright stems	composed of many (20–38) radiating stems
Stems	stout and upright	shorter, wiry, divaricate, *i. e.*, standing at an angle of less than 45° with the earth from the commencement of growth. When growing on little hillocks the stems project below the horizontal
Leaves	divaricate, lancolate-trifoliolate	appressed, linear-trifoliolate
Heads	cylindrical, larger	cylindrical, smaller relatively
Flowers and Fruit	no appreciable differences	

An ecologist meets with such a state of affairs quite frequently, and these extremely varying forms may occasionally be of such

* Planta caule procumbente ab initione, foliolis neariis, arenariam incolat.

significance that they must be distinguished from the usual forms, in any critical discussion of the vegetation. For this reason they deserve a name. As a single condition produces similar variation, it seems most logical to apply the same term to the results of similar conditions. Accordingly I propose that the term "arenarius" be used to designate those forms of species of plants in which xerophytic adaptations are induced by growth in sand. I append a description of such a form which has come under my observation.

TYPE. (Gates 2922) growing in sandy soil in the *Andropogon scoparius* consocies of the bunchgrass prairie at Waukegan, Lake County, Illinois, August 7, 1908.

PHOTOGRAPHS. Gates 163 (August 17, 1909) and Gates 347 (August 13, 1910), the latter of which accompanies this article as figure one.

Specimens may be consulted at the Herbarium of the University of Illinois, the Field Museum of Natural History in Chicago, (type) and the author's private herbarium.

A similar form of *Apocynum hypericifolium* was commented upon by Schaffner.* It may be termed *Apocynum hypericifolium* f. **arenarium.** Other such forms are under observation.

These forms are always easily recognized in the field, but herbarium specimens illustrating them are difficult to prepare. Consequently ordinary herbarium material, unless fully labeled does not furnish satisfactory data. This difficulty is in a large measure obviated by the use of the camera and the notebook in the field.

UNIVERSITY OF MICHIGAN.

THE BOTANICAL NAME OF THE WILD SAPODILLA

BY N. L. BRITTON

The wild sapodilla or wild dilly, recorded by different authors under various names, is of the genus *Mimusops*, and occurs in southern Florida and through the Bahama Archipelago from Abaco and Great Bahama to the Caicos Islands and Inagua.

* Ohio Naturalist **10**: 184. June 1910.

In the writings of Dr. Chapman, Dr. Gray, Prof. Sargent and Dr. Small, it is recorded from Florida as *Mimusops Sieberi* DC., a tree which is apparently restricted to the island of Trinidad and recently referred by Pierre to a variety of *Mimusops balata*. It is recorded from the Bahamas by Grisebach, by Dolley, and by Mrs. Northrop as *Mimusops dissecta* R. Br., which is an Asiatic species, and I have accepted for it (North American Trees 782) the name *Mimusops parvifolia* (Nutt.) Radlk.

The tree was first illustrated and described by Catesby in the second volume of the "Natural History of Carolina, Florida and the Bahama Islands" at plate 87. Professor Sargent (Silva **5**: 184) identified this plate with the tree under consideration. Like most of Catesby's plant illustrations, the figure is not wholly characteristic, but it is unmistakable to one familiar with the Bahama flora.

Sloanea emarginata of Linnaeus was based wholly upon this plate 87 of Catesby, but erroneously attributed by him to Carolina, and as this has priority over all other names given to the species, it should be used. Its synonymy is as follows:

Mimusops emarginata (L.)

Sloanea emarginata L. Sp. Pl. 512. 1753.

Mimusops parvifolia Radlk. Sitz. Akad. Wiss. Muench. **12**: 344 (misprinted *parviflora*). 1882. Not R. Br.

Achras Zapotilla parvifolia Nuttall, Sylv. **3**: 28. 1849.

Achras bahamensis Baker in Hook. Ic. **18**: *pl. 1795*. 1888.

Mimusops floridana Engl. Bot. Jahrb. **12**: 524. 1890.

Mimusops bahamensis Pierre, Not. Sapot. 37. 1891.

Mimusops depressa Pierre, Not. Sapot. 37. 1891.

Examination of the Cuban coastal flora at many localities has up to the present time failed to disclose the occurrence of this species there.

New York Botanical Garden.

SHORTER NOTES

An Undescribed Opuntia from Jamaica.—**Opuntia jamaicensis** Britton & Harris *sp. nov.* Erect, dull green, 1 m. high or less, subcylindric below, the several branches ascending, Joints obovate, much narrowed at the base, flat, rather thin, readily detached, 7–13 cm. long, 5–7.5 cm. wide; areoles about 2.5 cm. apart, those of the lower parts of the joints usually without bristles, the others bearing 1–5 (usually 2) acicular, unequal white spines 2.5 cm. long or less, with yellowish-green tips, the numerous glochides fulvous; flowers about 4 cm. broad, opening at 11 o'clock A.M. and beginning to close at 4 P.M.; sepals small, green, scale-like; petals 16–18, in about 3 series, those of the two outer series yellowish-green, triangular, 1.2 cm. long or less, apiculate; those of the inner series 6, light lemon-yellow with a reddish-brown streak at the middle, obovate-orbicular, 2.5 cm. long; filaments greenish-white; anthers white; style white, longer than the stamens; stigmas 7 or 8, creamy-white; fruit pyriform, concave at top, red, much narrowed at the base, 3.5–4 cm. long, 2–2.2 cm. thick, its areoles about 1 cm. apart, bearing many yellow-brown glochides; seeds densely persistently woolly, biconvex, brown, 4 mm. broad, 1.5 mm. thick, the raphe prominent.

Roadside plains near Salt Ponds, St. Catharine, Jamaica, *Britton & Harris, 10,887*, August 31, 1908 (type); same locality (*Britton 3069*); flowered at Hope Gardens, Jamaica, January, 1910, and fruited in April, 1910.

I tentatively refer the species to the series *Divaricatae* Salm-Dyck, from all of which it differs, however, in its erect habit and subcylindric trunk.

N. L. Britton.

New York Botanical Garden.

Some Records from the Potomac District.—The following collections made in the vicinity of Washington, D. C., during the summer of 1910, have seemed worthy of record.

Eleocharis flaccida (Spreng.) Urban, determined by Dr. N. L. Britton [= *E. ochreata* (Nees) Steud, of our manuals] collected at the mouth of Cameron Run, near New Alexandria, Fairfax Co., Va., Aug. 13, 1910, *Philip Dowell 6454, Pennell 2589.*

Growing in shallow water in company with a small *Eriocaulon*, possibly *E. Parkeri* Robinson.*

Veronica scutellata L. Same locality and date (*2591*). This species, as shown by specimens in the National Herbarium, has been collected several times previously along the Potomac River in the vicinity of Washington. As it occurs frequently in the mountain district of Pennsylvania and New Jersey, occasionally below this as at Tullytown, Bucks Co., Pa., and along the lower Susquehanna River, the range of this species in the manuals must be extended considerably southward.

Galinsoga caracasana (DC.) Sch. Bip.—In a moist corn field along the Potomac River above Great Falls, Fairfax Co., Va., collected Aug. 7, 1910 (*2519*), in company with *G. parviflora hispida* DC.

F. W. PENNELL.

UNIVERSITY OF PENNSYLVANIA.

PROCEEDINGS OF THE CLUB

MARCH 29, 1911

The meeting was held at the museum building of the New York Botanical Gardens at 3:30 P.M. Vice President Barnhart occupied the chair. Thirteen persons were present.

The minutes of the meeting of March 14 were read and approved.

The following communication from Miss Caroline C. Haynes was then read:

"Sixteen East Thirty-sixth Street,
New York City.

MR. BERNARD O. DODGE,
Secretary and Treasurer,
Torrey Botanical Club, Columbia University.

Dear Sir: It is desired by a number of the members of the club and by others interested, to establish a fund in memory of

* According to the determination of Dr. J. K. Small this is *Eriocaulon Parkeri.* The plant was heretofore known only from near Camden, N. J., and from near Bordentown, N. J., where it was collected by the writer of this footnote in August, 1910. Mr. Pennell's discovery of this plant near Washington, D. C., increases its known range about two hundred miles, and also reduces the number of plants strictly endemic in the local flora range.—N. T.

the late Professor Lucien Marcus Underwood, the income of which may be used to aid in the illustration of the Club's publications. It is hoped that this fund may reach at least $5,000.

I ask that you obtain from the Club its consent to administer such a fund, and enclose my check for $100, as an initial subscription drawn to the order of the Torrey Botanical Club.

Sincerely yours,

(Signed) (Miss) CAROLINE C. HAYNES.

February 15, 1911."

Dr. M. A. Howe made a motion that the Club establish a Lucien Marcus Underwood fund, the income of which shall be used in illustrating the publications of the Club, and that the secretary be instructed to convey to Miss Haynes the hearty and appreciative thanks of the Club for her generous initial subscription. The motion was unanimously adopted.

The resignations of Elizabeth Billings, Alice Knox, W. L. Sherwood and Rev. L. T. Chamberlain were read and accepted.

Dr. H. H. Rusby reported having received several acceptances to his invitations to become sustaining members of the Club.

First on the announced scientific program was a paper on "Virginia Fungi," by Mr. B. O. Dodge. After reviewing the literature relating to Virginia fungi the speaker gave a report on the fungi collected on the estate of Mr. Graham F. Blandy at White Post, Clark Co., Va., last September.

The second number on the program was on "A Little-known Mangrove from Panama," by Dr. M. A. Howe. The mangrove in question, *Pelliciera Rhizophorae*, a member of the Tea or Camellia Family, was found in association with *Rhizophora*, *Aviunnia*, etc., near the Pacific terminus of the Panama Canal. Specimens and photographs were exhibited. A description and discussion of this mangrove appeared in the April number of the JOURNAL of the New York Botanical Garden.

Meeting adjourned.

B. O. DODGE,
Secretary.

REVIEWS

The Codiaceae of the Siboga Expedition, including a monograph of the Flabellarieae and Udoteae*

The recent phycological work issued under the above title is one of the extensive series of monographs, now approaching completion, that embody the zoölogical, botanical, oceanographic, and geological results of the scientific expedition to the Dutch East Indies in 1899–1900 under the leadership of Dr. Max Weber, professor of zoölogy in the University of Amsterdam. The study of the specimens of the interesting family Codiaceae of the green algae obtained on this expedition was entrusted to Mr. and Mrs. Gepp of the Botanical Department of the British Museum. The numerous comparisons necessary for the proper determination of these East Indian specimens and the unexcelled advantages for a review of the species of the world offered by the collections of the British Museum and the Royal Botanic Gardens at Kew led quite naturally to a general monographic treatment of the principal sections of the family. And as these groups are particularly well represented in tropical and subtropical America the monograph will prove of much interest and importance to American students of the marine algae.

The general introduction to the monograph includes suggestive "genealogical trees" indicating the authors' views as to the relationships of the genera and of some of the species. The presence or absence of calcification is considered of primary importance and two series are accordingly recognized. The synopsis of genera shows sixteen groups of generic rank, as contrasted with the eight of Wille's treatment in the Engler & Prantl Natürlichen Pflanzenfamilien (1890) and the ten of his recent (1910) Nachträge to that work. *Flabellaria* Lamour. has been revived for a group of two species typified by the chiefly Mediterranean plant commonly known as *Udotea Desfontainii*. For a group of three species (two newly described) typified by Kützing's West Indian *Rhipilia tomentosa*, Kützing's generic

* A. & E. S. Gepp. The Codiaceae of the Siboga Expedition, including a Monograph of the Flabellarieae and Udoteae.

Siboga-Expeditie, Monographie 62: 1–150. *pl. 1–22.* F 1911. E. J. Brill, Leiden. 4to. Price, fr. 15.50.

name *Rhipilia* has been restored. *Rhipiliopsis*, *Rhipidodesmis*, and *Boodleopsis* are new generic names proposed for groups in which the authors have recognized no American species.

The treatment of the genera and species of the Codiaceae is based on years of careful study of the plants and the relevant literature and is characterized by historical accuracy, by usually successful efforts to examine original specimens, by a scrupulous regard for nomenclatorial types in applying generic and specific names, by a grasp of the really diagnostic characters, and by an eminently fair and judicial attitude toward the views of other workers in the same field. The authors are particularly generous in their acknowledgments of the efforts of the present reviewer toward an orderly and natural arrangement of the plants of this family. The confusions that have resulted from insufficient materials and from wrong application of the older names are being gradually cleared away, but much as to the life-histories and modes of reproduction of these attractive plants remains to be learned by some patient investigator who may have the opportunity to keep living specimens under more or less continuous observation for extended periods of time.

The admission that the paper under review is one of the very best types of a modern taxonomic monograph does not, of course, preclude the possibility of an honest difference of opinion as to some of the minor points involved, even among those who are in possession of the same basal facts. Whether or not *Avrainvillea sordida* Murray & Boodle *p.p.* is preferred to *Avrainvillea levis* Howe is simply a matter of codes of nomenclature or of their interpretation. The case is a complicated one and none of the prevalent rules of nomenclature is altogether definite as to its solution. But the reviewer has little doubt that many supporters of the Vienna Rules may be found who will hold that the combination *Avrainvillea sordida* was first effectively published by Mazé and Schramm and that its proper application is determined by the citation of the previously published diagnosis of *Udotea sordida* Mont. and not, as the Gepps hold, by the citation of a numbered specimen. The Vienna Rules, as is well known, avoided a definite and precise application by ignoring

the idea of nomenclatorial types and they certainly contain no warrant for asserting that the first specimen cited by Mazé and Schramm, which may or may not exist in any herbarium, "stands good as type" of *Avrainvillea sordida* Crouan. *Avrainvillea sordida* Crouan being really according to the Gepps' showing, a mix-up of five species, and the later *Avrainvillea sordida* Murray & Boodle being a mix-up of three, the adoption of "*Avrainvillea sordida* Murray & Boodle *p.p.*" as the "oldest specific name to which no doubt can be attached" strikes the reader as a trifle odd.

The adoption of the name *Avrainvillea Mazei* Murray & Boodle for the species for which the reviewer and Mr. F. S. Collins have of late used the name *Avrainvillea longicaulis* (Kütz.) Murray & Boodle *p.p.* hinges on the authors' doubts as to the identification of Kützing's *Rhipilia longicaulis.* Kützing's description and figures of this plant seem at first sight not altogether easy to harmonize with any one of the species recognized today. The original specimen or specimens, collected in the West Indies, apparently do not exist in the Kützing herbarium, now owned by Madame Weber van Bosse, and the authors of the monograph under review state that they have not seen them. Kützing in publishing *Rhipilia longicaulis* cited "Herb. Sonder." The reviewer, a few years ago, learning that the Sonder herbarium had become part of the National Herbarium of Victoria, Australia, wrote an inquiry to the acting curator of the latter herbarium who courteously replied that there was in the Sonder collection a specimen from Antigua bearing the name *Rhipila longicaulis* Kütz. He furthermore kindly enclosed small fragments, sufficient for a microscopic examination, from both flabellum and stipe. A study of these fragments led to the adoption of the name *longicaulis* for the species described by Murray and Boodle as *Avrainvillea Mazei.* The authors of the new monograph, relying upon Kützing's figure of flabellum filaments, which from the scale of magnification used appear to be much more slender that those of *A. Mazei*, have expressed doubts as to the correctness of the reviewer's interpretation of *Rhipilia longicaulis* and have suggested the disturbing possibility that the name *longicaulis* may have to be taken up for the species which they call

Avrainvillea sordida. The reviewer believes that a study of what is presumably the original specimen would convince them that no such unhappy step will be necessary and also that *longicaulis* is the legal specific name for the plant that they are calling *Avrainvillea Mazei.* The flabellum filaments of the Sonder plant have a diameter of 28–55μ, while those of *A. levis* (*A. sordida*) have a diameter of 6–24μ. Filaments with slender rhizoidal endings of the size and nearly the form figured by Kützing may be found in the stipe of the Sonder plant as well as in the stipes of most of the plants that are referred to *A. Mazei.* The true explanation of the peculiar character of the filament figured by Kützing is probably that although the filament may have come from the "Phyllom" as alleged, it came from so near the stipe as to have the characters of the stipe filaments. Furthermore, the natural-size figure given by Kützing, although the bifid flabellum depicted is rare and abnormal, has decidedly the habit of plants of the species called *A. Mazei* by the authors of the monograph and not the habit of plants of the species called *A. sordida.*

Under the discussion of *Penicillus* one finds the unexpected statement that the specimen in the British Museum issued as no. 1482 of the Phycotheca Boreali-Americana under the name *Udotea conglutinata* represents a diminutive and deceptive state of *Penicillus capitatus.* Mr. F. S. Collins in "The Green Algae of North America" has recently referred this number to *Udotea cyathiformis* and the present reviewer agrees with Mr. Collins in this determination. The specimen under this number in the New York Botanical Garden set of the Phycotheca is, like that in the British Museum, diminutive and possibly a "starveling," but the reviewer has seen and collected several intermediates between this condition and the larger explanate states of *Udotea cyathiformis.* The last-named species is often strikingly *Penicillus*-like in its structural characters, being scarcely more than a *Penicillus* with a cup-shaped or much flattened head, though its filaments are more coherent than in any recognized species of *Penicillus.*

Börgesen's "ingenious" but unsupported theory that *Clado-*

cephalus scoparius Howe is probably a condition of *C. luteofuscus* (Crouan) Börg. "developed under peculiar, most probably unfavourable external conditions of life" has been rejected by the authors of the monograph as also by Mr. F. S. Collins, though unfortunately it has been adopted by Wille in his recent Nachträge to the Engler & Prantl Natürlichen Pflanzenfamilien. In this connection it may be remarked that if any real evidence is ever brought forward to show that *Cladocephalus scoparius* and *C. luteofuscus* are forms of one species it may be contended with some justice that the legal name for the species will be *Cladocephalus scoparius*, inasmuch as the *Flabellaria luteofusca* of the Mazé and Schramm list remained essentially a *nomen nudum* until after the publication of *C. scoparius*.

An appendix to this admirable monograph contains Latin descriptions of the new genera and species proposed in the body of the work. Re-publication in this form has been considered desirable in order to conform to the requirements of the Vienna Rules, though it is pleasing to note that the authors have not ventured to reject a certain recently proposed specific name simply because it has never been accompanied by a Latin diagnosis.

Twenty-two handsome lithographed plates supplement in a most helpful manner this notable contribution to phycological literature.

Marshall A. Howe.

OF INTEREST TO TEACHERS*

Biology for College Entrance

The new plan for admission to Harvard, which aims to improve articulation with secondary schools, especially public high schools, reduces the examinations to four, which must be taken at one time. A satisfactory record in these examinations will admit to Harvard College without conditions: (*a*) English, (*b*) Latin, or for candidate for the degree of S.B., French or German, (*c*) Mathematics, or Science (Physics or Chemistry), (*d*)

* Conducted by Miss Jean Broadhurst, Teachers College, Columbia University.

any subject (not already selected under (*b*) or (*c*) from the following list: Greek, German, History, Mathematics, Chemistry, Physics. It will be noticed that botany (or zoölogy) is not mentioned here. Why is a question that might bring various answers, opening discussion and criticism of methods, adaptability and advisability of subject matter, and the cost of laboratories and biological materials. Many prominent teachers will also disagree as to the desirability of such intensive work in either botany (or zoölogy) as a position on the favored list may be supposed to indicate. Nevertheless there is no reason why the "open door" should not be offered to the biological sciences, be the applicants few or many.

In a discussion regarding the order of high school science courses (*School Science and Mathematics*, February, 1911) W. Whitney describes the science groups recommended by the principals of the Chicago high schools and recently adopted by the Board of Education of Chicago. It surely is, as the author indicates, "the first time any secondary school has systematically offered such opportunities in science."

"It must be understood that this science group is only one of some eleven groups of courses from which pupils are to make their selection by groups. The first year's work is to include physiology a half year and physiography a half year. In the second and following years there are to be offered one and one half years each of botany, zoölogy, physics, and chemistry and a year of physiography. A half year of each of the first four is to be of a practical or applied nature. The student on reaching the second year may choose between the biological and the physical sciences. If he chooses the biological, he will take three years' work in these sciences and two years of the physical. If he chooses the physical, he will take three or four years of the physical and one or two years' work in biological science. In any event, he must have six years of science.

"All will agree with the claim that in any scientific course of studies, if it be is to worthy of the name, there should be opportunity for a second year's work in, at least, one physical and one

biological science. There is no good reason why opportunity for advanced work should be given in business courses or in language courses and denied in the science courses. Science plays a large part in the affairs of man and should be given liberal treatment in any scheme of education."

An abstract of Dr. D. T. MacDougal's address before the Society of American Naturalists is given in *Science*, January 20, 1911. As an introduction the abstract lists the recent events in the field of evolution; gives brief statements of the present presentation of long-recognized evolutionary theories, such as isolation, geographical distribution, natural selection, and inheritance of acquired characters; and recent work showing organic responses, including the plant changes secured by MacDougal in treating the reproductive elements of seed plants with various solutions, by Gager in using radium, and by Zederbauer on *Capsella* by climatic changes. The different mutants of *Oenothera* secured in Amsterdam and New York are explained by the statement that "*latency* and *recessivity* of any character may be more or less influenced by the conditions attendant upon the hybridization." The abstract ends with a discussion of the permanency of acquired characters. Not all "environic effects induced in the laboratory or by transplantation are heritable, although these may be carried over for two or three generations: and no satisfactory basis has yet been found upon which it might be predicted that any effect would be ephemeral or permanent."

Speaking of color photography in botanical work, Franics Ramaley (*Science*, February 17) recommends that botanists "make use of the new color photography especially in studies of ecology and plant breeding. Many features of vegetation are brought out much more clearly than by ordinary photography. Thus, a moor with scattered shrubs or a lake-margin surrounded with belts of different plants can be well shown. In plant-breeding experiments the appearance of the different hybrids

and extracted forms can be reproduced with much faithfulness. Colored plates from books are easily reproduced upon lantern slides. The exposure required is about 200 times that for an extra rapid isochromatic plate. Hence no 'snap shots' can be taken, but if the light is good there need be no difficulty in securing good results. Development can be carried out in an ordinary dark room. The solutions used are inexpensive and easily prepared."

The August (1910) issue of the *Popular Science Monthly* contains an article on the rôle of selection in plant breeding. Another on the rôle of hybridization follows it for October. Deprecating the lack of discrimination in a public, with a "reputation for always looking for the dollar sign," the writer wonders that horticultural novelties of limited use and small importance are received with loud acclaim, when new agricultural productions of great economic value are almost unnoted. As an example of the latter class a ten per cent. increase in yield in corn might be given—an increase which would add $100,000,000 yearly to the wealth of the nation.

The discussion of selection and hybridization are well illustrated with photographs—chiefly corn and tobacco. The lack of proper credit mentioned above is probably due to insufficient knowledge concerning these two methods; ignorance which these articles are well adapted to destroy, with regard to range in variation, technique, the difficulties to be overcome, their relation to the natural method of flower pollination, the evils of inbreeding, and the interpretation of results in the newer phraseology—such as Mendel's law.

Cereal cropping and soil sterilization (*Science*, February 10) are discussed by H. L. Bolley of the North Dakota Agricultural College. He mentions (1) the large yields of high quality on new soils, (2) the deterioration in amount and quality that soon sets in, (3) that neither the exhaustion theory nor the toxin theory can satisfactorily account for the failure of such virgin soils to produce the earlier characteristic yields, (4) the improvement

in such soils due to soil sterilization, (5) the difference in conclusions reached by the Rothamsted workers and by Mr. Bolley; the injurious effect (after soil sterilization) upon the first growth of the (wheat) seedlings is thought to be due to fungi, parasitic upon the wheat itself rather than in the soils—fungi which with soil fungi account for the deterioration of wheat and other cereal crops, instead of protozoa affecting the ammonia-making bacteria as claimed by the Rothamsted workers.

In a paper read before Section G at Minneapolis Mr. Bolley describes several genera of imperfect fungi responsible for cereal crop deterioration (*Science*, February 17). The fact that quack-grass is a common host for most of these is thought to account for the destructive influence attributed to that plant.

The January *Plant World*, which by the way is appearing in a much more attractive cover, contains an article by Professor F. E. Lloyd on the behavior of tannin in persimmons. Recently several scientific papers have printed short articles on tannin, or have referred to problems connected with the presence of tannin in plant tissues. Professor Lloyd does not consider this paper his final word on the subject; nevertheless among his conclusions are: (1) the colloid character of tannin, (2) the cause of its insolubility (intimate and complete association with a second carrier, also a colloid), and (3) the absence of intercellular tannin in normal tissue.

Under "Some Useful Plants of Mexico" Dean Rusby describes (*Journal of New York Botanical Garden*, January, 1911) a large number of interesting plants of economic value in Mexico.

The Hawaii Agricultural Experiment Station calls attention to the perennial character and the vegetative propagation of the cotton plants grown there—older plants yielding sometimes a hundred cuttings each. The continuous growing season makes it possible to regulate the harvest time by judicious pruning—a great commercial gain.

Under "Soil Productivity" (*Science*, February 10) T. C. Chamberlin discusses (1) the early origin of soils and of soil vegetation; (2) the sources, wasting, and mixing of soils, the direct relation between film-water and productivity; (3) the great relative contact of soil air and the special advantage of its action; (4) the minute forms of plant and animal life which themselves more or less parasitic or predatory on each other modify the inorganic activities, and the fact that the "productivity of soils is measured more by the efficiency of its complex of activities than by any mere measure of its inorganic constituents"; (5) the importance of the capillary cycle in maintaining the supply of potash and phosphorus in the soils, and the selective action of certain soils in concentrating potash and phosphorus surfaceward; (6) that the capillary cycle and the plant cycle contribute to a potash and phosphorus cycle, and that "it is not, in the main, the *material substance* of the soil that is needed for food, but the *energy* locked up in grains, fruits, etc.," and therefore that the return of plants or their products to the soil is a most effective mode of maintaining soil productivity; (7) and that, despite alarming reports to the contrary, the lands most densely inhabited and intensely cultivated—at home and abroad—do, unit for unit, show an increase in productivity.

In answer to this Professor Cyril G. Hopkins has written a lengthy answer (*Science*, March 17) quoting the experiments at the Illinois State College and Rothamsted. At the latter place in a four-year rotation, including always a legume crop, "the yield of turnips decreased from 10 tons in 1848 to less than 1 ton per acre as an average for the last 20 years; that the barley decreased from 46 bushels in 1849 to 14 bushels as an average for the last 20 years; that the clover has decreased from 2.8 tons per acre in 1850 to less than one half-ton average since 1890; and that the wheat produced 30 bushels in 1851, and 33 bushels average during the next 12 years, but only 24 bushels since 1890, and 20 bushels per acre since 1900.

"As an average of the last twenty years the value of the four crops on the unfertilized land at Rothamsted is $33.83 (from four acres), but where the same crops were grown on adjoining land

to which mineral plant food had been applied the average value is $76.83, the increase being 140 per cent. above the cost of the minerals."

Professor Hopkins therefore questions encouraging the Whitney "doctrine" that it is never necessary at any time to introduce fertilizing material into any soil for the purpose of increasing the amount of plant food in that soil.

NEWS ITEMS

At the University of Chicago the following promotions have been made in the department of botany: C. J. Chamberlin from assistant to associate professor; H. C. Cowles from assistant to associate professor; W. J. G. Land from instructor to assistant professor; and William Crocker from instructor to assistant professor.

Mr. E. L. Morris, curator of natural sciences at the Brooklyn Institute Museum, has been appointed acting curator-in-chief to fill the vacancy occasioned by Dr. F. A. Lucas's resignation. Dr. Lucas has been appointed director of the American Museum of Natural History, New York.

The University of Michigan's announcement for the summer session of its Biological Station includes several courses in botany under Dr. H. A. Gleason. The Station will be located in a tract stretching from Douglas to Burt Lakes, Cheboygan Co., Michigan. The session will extend from July 3 to August 25.

Mr. Carl Sherman Hoar has been appointed as an assistant in botany at Harvard University, and the following have been appointed Austin teaching fellows for 1911-1912: R. H. Colley, A. J. Eames, and E. W. Sinnott.

We learn from *Science* (June 9) that a party from the University of Nebraska will spend the time from June 15 to September 15 in making an ecological survey of the central and western parts of the state. Recording instruments will be set up at intervals and a particular study of the ecology of the sandhills will be undertaken. The party includes R. H. Wolcott, F. H. Shoemaker, R. J. Pool, and C. V. Williams.

Cyrus Guernsy Pringle, for many years a collector for the American Museum and Harvard University, died May 15 at Burlington, Vt. Professor Pringle, who was seventy-three years old, made very extensive collections in Mexico and in parts of New England. In 1906 he received an honorary degree of Doctor of Science from the University of Vermont at which institution he was curator of the herbarium.

According to the *Evening Post* (June 10) Professor D. W. Johnson, of Harvard, will undertake a survey of the Atlantic coast. Special efforts will be made to determine the recently much-discussed question of coastal subsidence. Work will be carried on from Newfoundland to Florida.

From the same source we learn that Professor C. S. Sargent has been elected an honorary member of the Société Nationale d'Acclimation de France and of the Royal Irish Academy.

Professor R. A. Harper, of the University of Wisconsin, visited the Brooklyn Botanic Garden on June 4.

Alfred S. Goodale (Amherst, '98) has been appointed professor of botany at Amherst College.

On Saturday afternoon, May 13, the grounds of the Brooklyn Botanic Garden were opened to the public for the first time. Of the ten sections that will ultimately comprise the Garden's out-door collections, three are already established, at least in part. They consist of a Morphological Section, illustrating the forms and structures of plants; an Economic Section, including our common vegetables, medicinal plants, condiments, and fibers; and a Local Flora Section. The latter is an attempt to grow as many of our native wild plants as it is possible to get established under cultivation, and includes an artificial bog for the growing of plants requiring such an environment.

TORREYA

July, 1911

Vol. 11 No. 7

HERBARIUM SUGGESTIONS

By Edward L. Morris

This article is presented not with the idea of establishing anything specially new to those interested in herbarium work and equipment, but with the hope that the solutions suggested will answer some of the problems which many of us have run across from time to time.

Nearly everyone who has consulted American herbaria has noticed the enormous pigeon hole boards, indicating the contents of the herbarium, usually arranged by families. These large boards, if made of the size of the pigeon hole and hanging from the top of a full package, are awkward, unsightly, and have the disadvantage of being heavy, if made strong enough to stand wear and tear. We have also witnessed the other extreme, in some herbaria, by finding nothing whatever to indicate the contents of this or that tier of spaces in the cases; or, if such indication were fastened on the outside of the case, experience has often taught us that the location of such signs has not kept progress with the growth and redistribution of the covers in the series of pigeon holes.

Figure 1 indicates a very mild form of overhanging tags to show the location and sequence of plant families. The main difficulty is the readiness with which these tags are torn off, if fastened, or drop out, if merely slipped into the first genus cover. Uniformity is highly desirable, and when a system of family boards is once installed, the space alloted to such installation will remain constant.

Figure 2 is submitted with the suggestion that each family board takes little space, is of light weight and, in the use of the

[No. 6, Vol. II, of Torreya, composing pp. 125–144 was issued 19 June 1911.]

storage case, is sufficiently readable to meet any demand. The entire series of class, order, and family names has been printed on

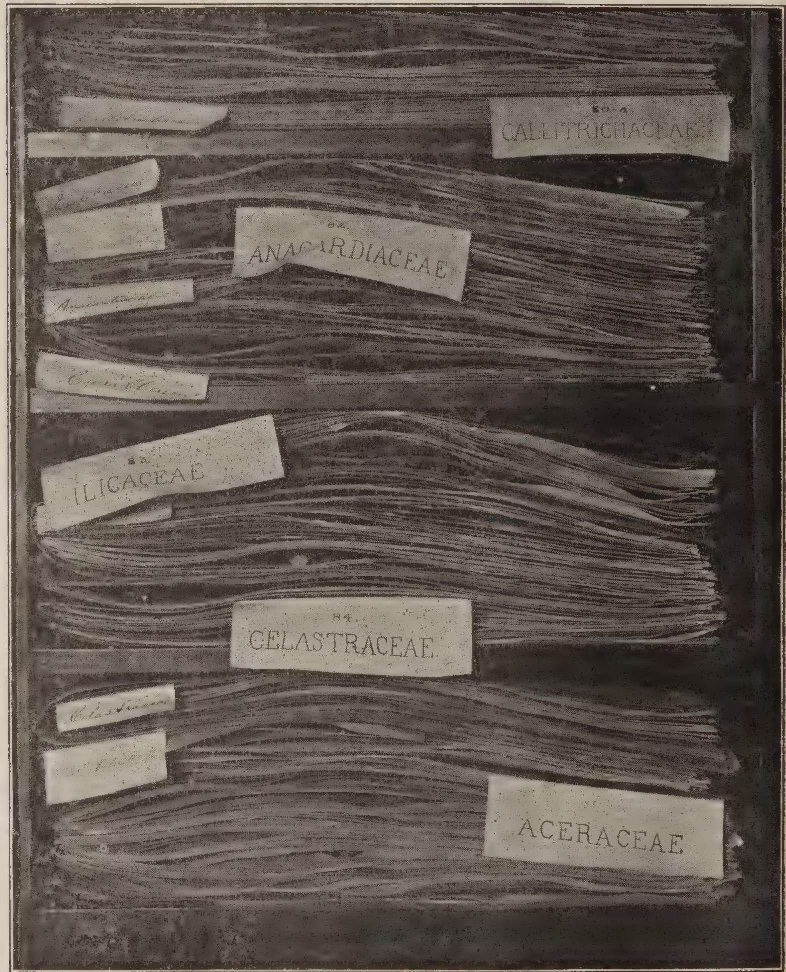

FIG. 1. Old style of Order and Family tabs.
Courtesy of Central Museum of the Brooklyn Institute of Arts and Sciences.

large sheets, so spaced that with the ordinary form of "compo board" the printing occupies the proper space on the edge of a 16½×11½ inch sheet of compo board. Experience with us

has shown that only the utmost carelessness on the part of a visiting student will result in the displacing of one of these boards from its proper location at the beginning of a family.

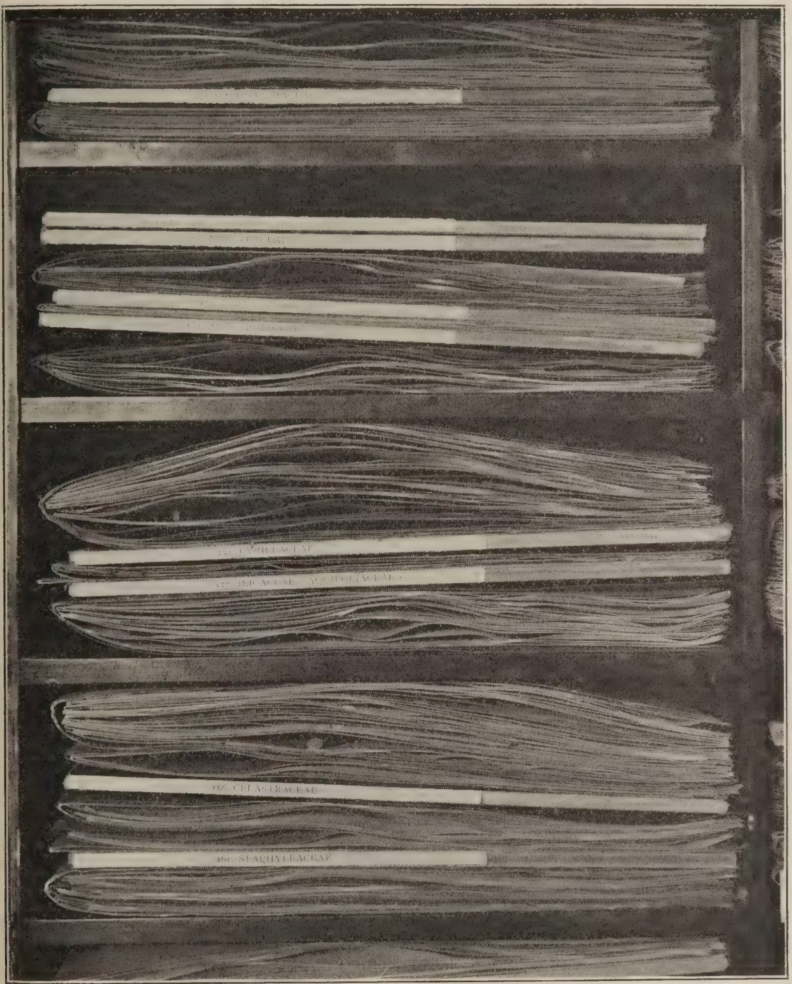

FIG. 2. Uniform Order and Family Boards.
Courtesy of Central Museum of the Brooklyn Institute of Arts and Sciences.

Under the old system of large hanging signs, if several families consisting of only a few species, appear in the same pigeon hole their names must be presented in series on one end board, or

on a sufficient number of tags to require their being placed in alternating positions. The compo board sheets, as suggested in

3672. LUPINUS

[**Tournefort** ex L., Syst. ed. 1 (1735).]
Linnaeus, Sp. Pl. ed. 1 (1753). 721.

Catalog card, reduced from the regular 75×125 mm. size.

3672. LUPINUS

[**Tournefort** ex L., Syst. ed. 1 (1735).]
Linnaeus, Sp. Pl. ed. 1 (1753). 721.

FIG. 3. Genus cover slip, reduced from 75×125 mm.
Courtesy of Central Museum of the Brooklyn Institute of Arts and Sciences.

Figure 2, will give all the family names in one vertical arrangement.

Genus covers are often entered in so many handwritings that their records are confusing, or at least trying. Uniform cards, arranged alphabetically in a catalog, give ready reference by the sequence number to the sequence itself in the proper family, that number and genus name being readily seen and recognized if the genus label is placed at the lower left hand corner.

Figure 3 is presented with sample reprints of a legible and durable catalog card and its genus cover slip duplicate. The mere matter of the card being printed at the top, and the slip being printed at the bottom, for more ready reference in their respective places, is but a matter of slight ingenuity on the part of any capable printer in adjusting two sets of guides on his platen so that both sets may be printed without removing the locked form from the press. The difference in thickness of card and slip is, of course, obviated by the proper make-ready on the platen. It often happens that herbaria, even those of a private nature, specialize in some local range or limitation. The ordinary buff genus cover does not require any discussion. Local species may be well distinguished from those of more general range by placing them in a genus cover of different color which may be placed immediately above the regulation buff one. "Red rope paper" is suggested as durable and suitable for such local indication and will wear as well as the ordinary buff tag board.

The writer will be very glad, through the generosity of the Central Museum of the Brooklyn Institute of Arts and Sciences, to furnish sample copies of the family lists, and representative genus cards and slips to those who have the intention of incorporating such a system for the more convenient use of their herbaria.

Central Museum of The Brooklyn Institute of Arts and Sciences,
Brooklyn, N. Y.

A RARE AND LITTLE-KNOWN PUBLICATION

By Arthur Hollick

About sixty years ago a monthly publication was issued under the title "The People's Medical Journal and Home Doctor," edited by Frederick Hollick, M.D., and published by T. W. Strong, 98 Nassau St., New York.

Volume I, Nos. 1–12, includes the period from July, 1853, to June, 1854. Volume II, Nos. 1–6, from July to December, 1854, when it terminated. A complete series is in my possession, and I have never seen, elsewhere, even a single copy of any one of the numbers.

The contents cover rather a wide range of subjects; many statements of fact are curiously at variance with our present knowledge, and much of the diction appears quaint and at times crude, according to our modern ideas of style and expression. Doubtless, however, it was classed as a reliable popular scientific journal at the time of its publication, and it probably reflected, more or less accurately, the popular ideas and scientific conceptions then prevalent on the subjects treated.

Among these subjects are many relating to botany. One series of articles is included under the title "Medical Botany of the United States," illustrated by a number of woodcuts of medicinal plants, with the scientific and popular names under which they were then known. The species figured are *Hepatica Hepatica*, *Hydrastis canadensis*, *Ranunculus acris*, *Coptis trifolia*, *Cimicifuga racemosa*, *Magnolia virginiana*, *Berberis vulgaris*, *Caulophyllum thalictroides*, *Podophyllum peltatum*, *Papaver somniferum*, *Sanguinaria canadensis* and *Eupatorium perfoliatum*. Their recognized and traditional properties and uses are described, and some of the remarks are interesting, when read in the light of what we have learned during the last half century. In connection with *Berberis*, for example, is the statement that "many people suppose that the pollen, or dust of the flowers, will cause *rust* in wheat, but the most careful experiments have proved this notion to be entirely without foundation." The

alleged use by the Indians of so many different plants is commented upon as follows: "We would here ask how it is that the Indians were supposed to have so much experimental knowledge of medicinal plants . . . if they really found out all that is attributed to them they must have been tolerably well afflicted and for a long time. The fact is these "*Indian Remedies*" are, for the most part, gross humbugs, and were never known until the white men compounded them."

Other series of articles are entitled "The Natural History of Perfumes and Flowers," and "Chapters on the Physiology of the Origin of Life." From the latter we learn that "the vegetable kingdom is divided by the philosophical botanist into two great classes, the *cellulares* and the *vasculares;* the former containing the lowest, and therefore the least complicated forms . . . some orders of *algae*, the *Desmidae* and *Diatomaceae*, for example, are equally claimed by the botanist and the zoologist, so uncertain is it to which department of science they truly belong."

In describing the systematic position of plants both the natural and the Linnaean systems of classification are used, as for example: "ANISUM. *Pimpinella anisum.* Anise. Belongs to the natural family *Umbelliferae* and to the Linnaean class and order *Pentandria Digynia.*"

"ANTHEMIS. *Anthemis nobilis.* Chamomile. Belongs to the natural family *Compositae* and to the Linnaean class and order *Syngenesia Superflua.*"

There are also directions for growing "simples" and how to prepare various lotions, emulsions, salves, tinctures, etc., from them.

In his farewell editorial the editor says that "he finds it utterly impossible, once a month, to prepare the matter for a No. of the Journal . . . he cannot bestow that attention upon his task which it requires, and assistance of the right kind cannot be procured . . . in addition to the above reason, we also find that a monthly issue is liable to many irregularities . . . our subscribers mostly receive their Nos. by post, or rather *should do so* . . . but a large portion of them never reach their destination and have to be sent again, sometimes two or three times over.

The trouble and loss which is thus experienced is incalculable, and only becomes greater as our subscribers increase." From which we infer that the scientific and business trials and tribulations of an editor were similar then to those of today.

New York Botanical Garden

SHORTER NOTES

Opuntia Tracyi sp. nov.—Low, diffusely much branched, pale green, about 2 dm. high or less. Older joints oblong to linear-oblong, flat, 6–8 cm. long, 1.5–2.5 cm. wide, about 1 cm. thick; young joints scarcely flattened or terete, 1 cm. thick; areoles elevated, 5–10 mm. apart; spines 1–4, acicular, light gray with darker tips, 3.5 cm. long or less; glochides numerous, brownish; corolla pure yellow, 4 cm. broad; ovary 1.5 cm. long, bearing a few triangular acute scales similar to the outermost sepals, which are 2 mm. long; sepals triangular-ovate, 5–15 mm. long, the outer green, the inner yellowish with a green blotch; petals obovate, apiculate, 2–2.5 cm. long; filaments light yellow, 1 cm. long, anthers white.

In sandy soil near the coast, Biloxi, Mississippi, *S. M. Tracy*, May, 1911; flowered at New York Botanical Garden May 12–13, 1911 (*33786*, type). The plant was collected some years ago by Mr. C. L. Pollard near the same locality (*1139*) and distributed as *O. Pes-corvi* LeConte, which differs in having larger flowers, longer and wider joints and stouter, dark brown spines.

N. L. Britton.

FIELD MEETINGS FOR JULY AND AUGUST

The field committee announce the following field meetings from July 22–August 26 inclusive. The work of the committee would be greatly facilitated if those able and willing to act as guides would send their names to the chairman. Kindly state the days you could serve, whether whole- or half-day trips, and the localities with which you are familiar.

July 22. Wakefield, N. Y. Meet at Grand Central Station, 1:15 P. M. Meet guide, Mr. R. S. Williams, at Wakefield Station.

July 29. Springfield, L. I. Meet at Long Island Ferry, 34th St., 9 A. M. Guide, Mr. F. J. Seaver.

August 5. Mosholu, N. Y. City. Meet at 155th Station Elevated R. R., 1 P. M. Guide, Dr. William Mansfield.

August 12. New Baltimore and Coxsackie, N. Y. Meet at New Baltimore Hotel, 9 A. M., August 12. Fare, $5.00. Hotel rates, $2.00 per day. Guide, Dr. E. B. Southwick.

August 19. Pelham Bay Beach. Meet at Bartow Station, Pelham Bay Park, 1 P. M. Guide, Dr. M. A. Howe.

August 26. Moonachie, N. J. Meet at Rutherford Trolley, Hoboken, 1 P. M. Guide, Mr. G. V. Nash.

E. B. Southwick, *Chairman*.

The Arsenal, Central Park,
N. Y. City.

PROCEEDINGS OF THE CLUB

April 11, 1911

The meeting of April 11, 1911, was held at the American Museum of Natural History at 8:15 P.M. Dr. E. B. Southwick presided. Thirty-two persons were present.

The regular order of business was dispensed with and the announced lecture of the evening on "Poisonous Mushrooms," by Dr. W. A. Murrill, was then presented. The lecture was illustrated with many lantern slides. An abstract of the lecture prepared by the speaker follows. A more complete discussion of the subject by Dr. Murrill may be found in the November number of Mycologia for 1910.

"Considering its importance, it is remarkable how little is really known about this subject, most of the literature centering about two species, *Amanita muscaria* and *Amanita phalloides*, which have been the chief causes of death from mushroom eating the world over.

"As the use of mushrooms in this country for food becomes more general, the practical importance of this subject will be vastly increased, and it may be possible to discover perfect antidotes or methods of treatment which will largely overcome the

effects of deadly species. This would be a great boon even at the present time, and there will always be children and ignorant persons to rescue from the results of their mistakes. Another very interesting field, both theoretical and practical in its scope, is the use of these poisons in minute quantities as medicines, as has been done with so many of the substances extracted from poisonous species of flowering plants, and even from the rattlesnakes and other animals. Thus far, only one of them, the alkaloid muscarine, has been so used.

"The poisons found in flowering plants belong chiefly to two classes of substances, known as alkaloids and glucosides. The former are rather stable and well known bases, such as aconitine from aconite, atropine from belladonna, nicotine from tobacco, and morphine from the poppy plant. Glucosides, on the other hand, are sugar derivatives of complex, unstable, and often unknown composition, such as the active poisons in digitalis, hellebore, wistaria, and several other plants.

"The more important poisons of mushrooms also belong to two similar classes, one represented by the alkaloid muscarine, so evident in *Amanita muscaria*, and the other by the deadly principle in *Amanita phalloides*, which is known mainly through its effects. Besides these, there are various minor poisons, usually manifesting themselves to the taste or smell, that cause local irritation and more or less derangement of the system, depending upon the health and peculiarities of the individual.

"The principal species of poisonous fungi were illustrated by colored lantern slides, the series containing *Amanita cothurnata* Atk., *Amanita muscaria* L., *Amanita phalloides* Fries, *Amanita strobiliformis* Vittad., *Clitocybe illudens* Schw., *Inocybe infide* Peck, *Panus stypticus* Fries, *Russula emetica* Fries, and several other poisonous species of interest."

Meeting adjourned. B. O. DODGE, *Secretary*.

APRIL 26, 1911

The meeting of April 26, 1911, was held in the museum building of the New York Botanical Garden at 3:30 P.M. Vice-president Barnhart presided. Twelve persons were present.

The minutes of the meetings of March 29 and April 11 were read and approved.

The first number on the announced scientific program was a paper on "Fern Collecting in Cuba," by Mrs. N. L. Britton. This paper is published in full in the *American Fern Journal*, Vol. I, p. 75.

The next number was a discussion of "Fern Venation," by Miss Margaret Slossen. A more complete discussion of the subject by Miss Slossen may be found in her book "How Ferns Grow."

The meeting then adjourned to the Fern House of the New York Botanical Garden under the guidance of Mrs. N. L. Britton for a further study of ferns.

B. O. DODGE, *Secretary*.

REVIEWS

Hunter's Essentials of Biology and Sharpe's Laboratory Manual in Biology

Essentials of Biology* is the title of a new and fuller book by George William Hunter, designed also apparently to fit the New York City syllabus. It is accompanied by Richard W. Sharpe's Laboratory Manual in Biology.†

Hunter's volume is a great improvement over his earlier book in content, illustration, and correlation of the three subjects, botany, zoölogy and physiology. The problem idea which runs throughout is a good one, but all the subject matter does not lead itself readily to this arrangement (*e. g.*, the patent medicine discussion). Fertilization is not really explained by the text (p. 36) and alternation of generations as treated under mosses can mean nothing until after the following chapter on ferns has been completed. There are also a few misleading statements, such as the storing of proteids for future use (p. 345), the implied "osmosis of starch" (p. 106, p. 356) and that plants absorb only useful substances (p. 32). These graded reference lists are helpful, and the varied illustrations add much to the value of the book.

* Hunter, George William. Essentials of Biology Presented in Problems. Pp. 448. American Book Company. 1911.

† Sharpe, Richard W. A Laboratory Manual for the Solution of Problems in Biology. Pp. 352. American Book Company. 1911.

The manual is most attractively spaced; and unusually well-illustrated for a laboratory manual. The questions and special reports are varied and interesting. Some of the questions (*e. g.*, on nutrition) seem too difficult; as do one or two of the graphic charts; and ray flowers and petals are confused (p. 31). Some good tables, directions, etc., are included; the clay-pipe charcoal experiment is one of several neat devices.

These books ought to do much to secure sufficient uniformity of treatment of the "syllabus" to enable New York City teachers to estimate its real value. They must also prove a great help to many of the present uncertain interpreters of it and of "nature" and should lead to great improvement in the content and presentation of first-year biology.

JEAN BROADHURST.

OF INTEREST TO TEACHERS*

Professor E. L. Thorndike discusses methods of testing the results of the teaching of science (*School Science and Mathematics*, April). It contains much that is helpful to biology teachers in estimating the results obtained, but only the definite suggestions are quoted here.

"The topic which I am to discuss is one of enormous complexity. The changes in human beings which result from the teaching of science in schools are real, are measurable, and will some day be defined in units of amount as we now define changes in the rate of a moving body or in the density of a gas. But they include thousands of different elements; they vary with every individual; some of them can be demonstrated only long after school is completed; and at present units and scales in which to state changes in knowledge, power, interests, habits and ideals are mostly matters of faith. An adequate measurement of the changes wrought in one class by one course in physics would be a task comparable to a geological survey of a state or an analysis of all the materials in this building."

* Conducted by Miss Jean Broadhurst, Teachers College, Columbia University, N. Y. City.

Professor Thorndike's suggestions fall "into two divisions according as one searches for means of measuring the specific information, skill, interests, and habits added by courses in science, or the more general changes in total mental make-up—in, for instance, open-mindedness, accuracy, zest for verification and the like.

"The specific changes are, of course, the easier to measure. Indeed, my first suggestion is that we make scientific use of the measurements that we already make. For example, the regular school examinations are, or should be, careful scientific measures of important changes in our pupils. If we would test our classes with the examinations set by other teachers, have the pupils' work graded by other teachers, and print questions, work and grades, we should be making a start toward a real measurement of educational achievement. If examinations are worth giving at all, they are worth giving, at least occasionally, in such a way as to measure not only how well a pupil has satisfied some particular person, but also what he really is or knows or can do in certain special fields.

"We need thousands of significant questions, in each science, thousands of 'originals' in physics, chemistry and biology like the originals of geometry; and above all we need to have thousands of classes tested by outside examiners; for if an examination, instead of being a hasty, subjective selection of questions, graded still more personally (and alas, how hastily), were made a serious educational measurement, the examination papers of a year would alone give us a large start toward knowledge of what science teaching actually does.

"Knowledge may, however, be measured more conveniently than by the examination of notebooks, essays, or replies to questions of the ordinary sort. These have the merit of adequacy and richness, but the defects of measuring too many things at once and too indefinitely. Greater uniformity in the use of the test, quickness in scoring it, and freedom from ambiguity in the numerical value assigned can be secured by the exercise of enough ingenuity. I will mention two tests as samples of the many that are possible. The first is an adaptation of a test,

devised by Ebbinghaus to measure mental efficiency in general, in filling in words omitted from a passage. From even the hastily devised sample presented here it will be seen that this form of test is scored with reasonable ease. The speed of an individual in selecting words to fill the gaps and the appropriateness of his selections together measure his knowledge. The former is scored with no effort at all and the latter with far less effort than is required to evaluate answers to questions, essays or experimental work. The paragraphs and omissions therefrom should be arranged with care and improved after trial, but it may be of interest to some of you to compare the ratings obtained in six or eight tests of five minutes each like the following:

"A body changing its position in space moves in a certain ....at a certain .... A..............in the ....called acceleration. To change either the ....or the......................of a moving ....requires...... Suppose a pound of lead to be held at rest 500 feet above the surface of the ocean by a string to be cut. The body will..................toward the and etc.

"The second is a very simple development of so-called association tests which I have used with good success in regular examinations in psychology for a number of years. It needs no explanation other than a sample.

"Write after each of these words some fact which it suggests to you.

acceleration	gravity	current	lever
density	expansion	elastic	inclined"

"This test may be modified by selecting given words much less easily provocative of thoughts about facts of science, and being mixed, if necessary, with words that would call up facts of science only in a person absorbed by scientific interests.' Of course if 'such association tests are to be used to measure interest, they should not be used previously in the form calling definitely for facts about science.' These tests of interest may be used to measure both special interest in particular sciences and general interests, as in fact rather than fiction, knowledge rather than opinion, or verification rather than dispute.

"Of course means of measuring the general changes wrought by the study of science I will mention only two. The first concerns the power to utilize experience well in thought.

"What is needed for this purpose is a series of problems or tasks, relative success with which depends as much as possible upon having power to use experience and as little as possible upon having had certain particular experiences. For example, relative success with the problem, "Which is heavier, a pint of cream or a pint of milk?" is determined largely by ability to select in thought the essential fact that cream rises and to infer its obvious consequence. The data themselves are possessed adequately by all, or nearly all, pupils alike.

"To get such problems we wrote some time ago to one hundred teachers of science, half in universities and colleges, and half in secondary schools. I quote some of them:

"Rain drops are coming straight down. Will a car standing still or one moving rapidly receive in one minute the greater number of drops on its roof and sides?

"Since it is possible, for a person to float in water why is it possible for him to sink?

"A cylinder and a cone equal in base and in altitude rest on a plane surface. Which is harder to tip over?

"A magnet attracts two iron nails. If the magnet is removed will the nails attract each other?

"Does an iron ball weigh more when it is hot than when it is cold?

"If a bottle of gas which is lighter than air be placed with its open mouth upward, will the gas escape from the bottle or will the heavier air press the gas back into the bottle?

"Will a ship that will just barely float in the ocean, float on Lake Erie?

"Will a pound of popcorn gain or lose weight or stay the same after it has been popped?

"The second means of measuring changes in general power to think is an adaptation of one devised by Professor R. S. Woodworth, in which the pupil picks out from such a series as that below, the statements that are logically absurd, not possibly

true. It will be seen that statements could be chosen which would test the power of analysis and of thinking things together in any field of science from the most specialized to the most universal. Following is an example of this form of test.

"Put a mark in the margin opposite each of the following sentences which is absurd:

"Though armed only with his little dagger, he brought down his assailant with a single shot.

"Silently the assembly listened to the orator addressing them.

"While walking backwards he struck his forehead against a wall and was insensible.

"I saw his boat cleaving the water like a swan.

"With his sword he pierced his adversary, who fell dead.

"The storm which began yesterday morning has continued without intermission for three days.

"That day we saw several ice-bergs which had been entirely melted by the warmth of the Gulf Stream.

"Our horse grew so tired that finally we were compelled to walk up all the hills.

"Many a sailor has returned from a long voyage to find his home deserted and his wife a widow.

"The two towns were separated only by a narrow stream which was frozen over all winter.

"The great advantage of these means of measuring intellectual ability lies in their rapidity and objectivity. If well devised, only two answers are possible, the pupil is measured easily, rapidly, and independently of subjective factors, and his condition is defined in terms of a simple numerical value.

"There is no time for me to discuss methods of making, recording and utilizing these or the hundreds of other equally worthy measurements of educational achievement, that is, of changes produced or prevented in human nature. Nor is this a proper occasion to outline the precautions that are required by the complexity and variability of facts of intellect and character and the absence of well-defined scales with equal units and known zero points, in which to measure facts of intellect and character. For our present purpose it is enough to know that, in spite of

difficulties, the measurements can be made, and that a man of science can, if he will, be as scientific in thinking about human beings and their control by education, as in thinking about any fact of nature."

THE BEST METHODS OF TEACHING BOTANY TO SCHOOL STUDENTS*

It would seem that the title of the present address should read The Method of Teaching Botany, since I should argue that there is only one method deserving mention, namely the experimental. Perhaps I should say that I do not underestimate the value of purely observational processes; but unless these lead up to some sort of experimental trial or test it would seem that such method is inadequate in scientific education. Students of agriculture are concerned chiefly with the behavior of plants rather than with the form of plants. One can scarcely imagine circumstances under which a farmer would find it necessary to describe in technical language the form of a leaf or the structure of a flower. The important thing for him is to know what the functions of the various parts are and how they behave. If he knows this, he may then go further if he will. The inference from this is that our education should aim at cultivating the habit of mind which looks for the exact behavior of plants and is able to sift out the causes of variation in behavior. In the brief time at my disposal, I can do no more than to point out some fundamental ideas underlying the successful application of the method of experimentation.

In the first place, the proper attitude of mind in the teacher is most essential. He must have constantly before his mind the fact that plants are living organisms. To be sure they do not move as do animals and we therefore are sometimes slow to regard them as being as much alive as animals are; and one of the practical difficulties in education is to get our pupils to realize this. If plants are living, then the idea of change constitutes

* From an article by Professor F. E. Lloyd in a report on Agricultural and Industrial Education, Department of Agriculture, Montgomery, Alabama.

the key-note of our thought about them. It is the purpose of experiment to determine how these changes are related to changes in the environment, how the organism adapts itself into the circumstances surrounding it. A science which has to do with such phenomena should be vividly alive itself; its methods should be plastic and should not be hampered by custom or habit. The essential point is to get at the truth, and the way to get at the truth is to observe carefully what goes on in nature, realizing all the time that organic nature is nothing but a complex experiment, or to observe by means of special experiment, consciously undertaken. . . .

Teachers are very frequently overawed by what they assume to be the difficulty of conducting experiments. They very easily give way to fear that it involves too much apparatus and it is assumed too frequently that experimentation involves large expenditures of money for apparatus. Aside, however, from exceedingly abstruse work, a vast amount of good experimentation can be done with very little apparatus, if indeed we may call it that at all. The simplest means frequently answer the purpose as well as elaborate apparatus.

The feeling is frequently entertained also that experimentation is too complex for a young student, that it is altogether too difficult and that therefore the work of young pupils must be confined to pure observation. The answer to this is obvious. The real difficulty of science lies not in the method by which knowledge is gained but by the complexity of materials with which it happens to deal. A successful teacher in this regard is one who can skillfully select the materials and subjects for experimental work. In fact, scientific workers are constantly on the out-look for favorable material, as it is called, that is to say, material which gives the desired result with the greatest ease. For example, we choose the grain of Indian corn for work with pupils because it is large and because the young plant is easily studied for the same reason. We might get the same facts by studying the germination of millet but this would entail the use of a magnifying glass or even a microscope while Indian corn may be studied equally well with the naked eye. If on the other hand, we are

studying the behavior of a plant toward the light, we choose one which responds readily and grows quickly. Here millet would perhaps be better than Indian corn. . . . Knowledge is to us real in precise proportion to our actual contact with the things themselves. The most vivid ideas about plants are gained by experimenting with the plants themselves; not even reading a full account of an experiment will take the place of doing it, however successful or unsuccessful that may be. The teacher can always rest upon one certainty, namely that the experiment always tell the truth. To be sure, it may not come out as we expect, but it comes out exactly as it should. Our business is to know what the conditions are and we find this out sometimes only by means of a so-called insuccessful experiment.

The result of this kind of teaching cannot be over-estimated. An agricultural class made up of thoughtful farmers who are willing to experiment for themselves would mean a very great advance in mental development and in material prosperity. This is one of the great aims of agricultural education, namely to cultivate a critical and inquiring frame of mind. We hardly say too much when we declare that success in this direction will be a measure of the amount and the character of experimental work that is done in our schools.

NEWS ITEMS.

Robert A. Harper, Ph.D., now professor of botany in the University of Wisconsin, is to become Torrey professor of botany at Columbia University; succeeding the late Lucien M. Underwood. He was graduated from Oberlin College in 1886, received the degree of Ph.D. at Bonn in 1896, and after service in Gates College, and secondary schools, became in 1891 professor in Lake Forest University. In 1898 he went to the University of Wisconsion.

Dr. John W. Harshberger, assistant professor of botany at the University of Pennsylvania, whose monumental work on the plant geography of North America has just appeared, has been advanced to professor of botany.

The announcement is out for the Bradley Bibliography of woody plants issued by the Arnold Arboretum. The work is a "guide to the literature of woody plants, including books and articles in the proceedings of learned societies, and in scientific and popular journals, published in all languages to the end of the nineteenth century." The completed work is in five volumes, the first of which will appear in July, and the succeeding volumes as rapidly as possible.

Professor W. R. Dudley of Leland Stanford University died June 4 at the age of 62. Professor Dudley was born at Guilford, Conn., studied at Cornell, Strasburg and Berlin, and was appointed professor of botany at Stanford in 1893. He was specially interested in the plants of central California in relation to distribution and descent, and in the forests of California.

Professor Fernald, of the Gray Herbarium, is the leader of a party consisting of Professor Wiegand, Messrs. E. B. Bartram, Bayard Long, and H. T. Darlington, which is to explore the northeast coast of Newfoundland. The party left Boston on June 30.

The Gray Herbarium of Harvard University is to have a new two-story fireproof structure, sixty feet long and thirty wide, for laboratory work. The lower floor will be devoted to systematic and geographic botany and the upper floor will house the herbarium of the New England Botanical Club. The building, together with $10,000 for equipment, is the gift of Mr. G. R. White, of Boston. Casimir de Candolle has presented a bust, by Hugues Bovy, of his father, Alphonse de Candolle, in remembrance of the friendship between his father and Asa Gray.

TORREYA

August, 1911

Vol. 11 No. 8

SEED WEIGHT IN STAPHYLEA AND CLADRASTIS

By J. Arthur Harris

In an interesting paper on light and heavy seeds in cereals Waldron* concludes that in oats, plants with shorter culms, shorter heads, and a smaller number of grains per head bear on the whole grains of greater weight. Waldron's interest in the problem was that of the plant breeder, concerned in determining the results of selecting large or small seeds for planting, but they seem suggestive for the physiologist as well.

The explanation which the physiologist would at once suggest is that the competition of an abnormally large number of seeds for the available plastic material has, as a necessary result, a limitation of the size of the individual seeds. While this seems a very reasonable interpretation, one who has had experience in the actual study of such phenomena will hesitate in accepting it without further evidence. The discrimination and measurement of the individual factors underlying such functions as fertility and seed weight is an exceedingly difficult problem. As an example, take the following case. If the seeds are smaller in the larger inflorescences of Waldron's cereals because of the finer partition of the available plastic material, one would *a priori* expect that there would generally be a negative correlation between the number of fruits per inflorescence and the number of seeds which these fruits produce. So far as observations are available this is not the case.

For a series of the climbing bitter sweet, *Celastrus scandens*,† the correlations are:

* Waldron, L. R. A Suggestion regarding Heavy and Light Seed Grain. Amer. Nat. **44**: 48–56. 1910.

† Ann. Rept. Mo. Bot. Gard. **20**: 116–122. 1909.

[No. 7, Vol. II, of Torreya, comprising pp. 145–164, was issued 19 July 1911.]

Flowers formed per inflorescence and seeds developing per fruit,

$$r = .033 \pm .013.$$

Fruits maturing per inflorescence and seeds developing per fruit,

$$r = -.012 \pm .013.$$

For large series of *Staphylea trifolia* from the Missouri Botanical Garden the correlations have been determined both between number of fruits developing per inflorescence and number of seeds maturing per locule and between position of fruit on the inflorescence axis and number of seeds maturing per locule. The same relationships for the ovules per locule are available for comparison.* Table I. shows how slender the relationships are.

TABLE I

Character of Inflorescence	Character of Fruit	
	Seeds per Locule	Ovules per Locule
Number of fruits per inflorescence:		
General sample, 1906, 2,059 fruits. .	$-.0474 \pm .0086$	$+.0391 \pm .0086$
General sample, 1908, 4,033 fruits. .	$-.0494 \pm .0061$	$+.0633 \pm .0061$
General sample, 1909, 2,082 fruits. .	$+.0626 \pm .0085$	$-.0539 \pm .0085$
Mean for 20 individual shrubs of 1906 series.	$-.0399 \pm .0080$	$+.0192 \pm .0185$
Position of fruit on inflorescence:		
General sample, 1906, 2,059 fruits. .	$-.0148 \pm .0086$	$-.0501 \pm .0086$
General sample, 1908, 4,033 fruits. .	$-.0077 \pm .0061$	$-.0519 \pm .0061$
General sample, 1909, 2,083 fruits. .	$+.0128 \pm .0085$	$-.0895 \pm .0085$
Mean for 20 individual shrubs of 1906 series.	$-.0310 \pm .0088$	$-.0733 \pm .0177$

A comparison of these results shows how great caution should be used in discussing the factors underlying seed development, and how urgently further quantitative data are needed. The accumulation of such data necessarily proceeds slowly and the cooperation of many workers is desirable. The purpose of this

* The data upon which all these constants are based, with discussions of their significance, are to be found in three papers by the writer of this note: Further Observations on the Selective Elimination of Ovaries in *Staphylea*. Zeitschrift f. Ind. Abst- u. Vererbungslehre **5**: 173–188. 1911. Observations on the Physiology of Seed Development in *Staphylea*. Beihefte z. Bot. Centralbl. In press. The Influence of the Seed upon the Size of the Fruit in *Staphylea*. Bot. Gaz. In press.

note is to put on record the results of a couple of series of weighings which seem of interest in this connection.

The pods of the American bladder nut, *Staphylea trifolia*, are characterized by the production of few seeds. In a large series of countings it will be found that the great majority of fruits produce one or two seeds only; those with more than six are very rare. This is shown in Table II. for 4,024 fruits collected

TABLE II

Total Seeds per Fruit	Number of Fruits	Total Seeds per Fruit	Number of Fruits
0	4	8	16
1	1,585	9	9
2	1,240	10	5
3	637	11	2
4	310	12	1
5	125	13	—
6	59	14	—
7	30	15	1

from eleven shrubs in the North American Tract of the Missouri Botanical Garden in the fall of 1905. The polygon is very skew, the pronounced mode being a single seed while the frequencies fall off rapidly as the number of seeds become larger. In the collections from individual shrubs the empirical mode is sometimes on two instead of one, but the conspicuous skewness is a feature of all of the several series of *Staphylea* fruits hitherto examined. The same skewness is observed in Table III. for number of seeds per locule (of which there are three per fruit).

TABLE III

Seeds per Locule	Number of Locules	Seeds per Locule	Number of Locules
0	5,684	4	72
1	4,593	5	19
2	1,387	6	4
3	313		

I have been able to study fruits from only a single tree of the yellow wood, *Cladrastis tinctoria*, in the Arboretum of the Missouri Botanical Garden. Possibly because of its isolation, the fruiting of this individual is not typical of the species, but in

the 2,128 pods examined to determine the number of seeds developing (Table IV.) one notes a skewness of distribution similar to that in *Staphylea.*

TABLE IV

Seeds per Pod	Number of Pods	Seeds per Pod	Number of Pods
1	1,423	4	25
2	560	5	4
3	116		

Now it seems of interest to determine whether (in fruits which produce on an average so few seeds and among which those producing several are very rare) the weight of the individual seeds is in any degree dependent upon the number formed in the fruit.

The seeds of *Staphylea* are particularly suited to work of this kind. They are hard, smooth and clean; seeds which have an imperfect development—so far as can be ascertained by external examination—are exceedingly rare. *Cladrastis* seeds are not so suitable for weighing. Here as in many Leguminosae ovules which have failed to mature completely are sometimes found. All apparently blighted seeds were picked out before the weighings were made and we are consequently dealing with a sample of apparently sound seeds. The discarding of these should not vitiate the results.

TABLE V

Total Seeds per Fruit	Number of Seeds Weighed	Mean Weight	Total Seeds per Fruit	Number of Seeds Weighed	Mean Weight
1	150	.05978	5	150	.05265
2	150	.05988	6	150	.05145
3	150	.05662	7	100	.05377
4	150	.05353	8	50	.04680

Table V. shows the average weight of seeds of *Staphylea* from pods with different numbers of seeds per pod. The material is that of the fall of 1905. The results here seem to show very clearly that the difference between the weight of seeds produced in pods maturing one and two seeds is not very great, but when more than this number are developed the weight of the seed materially decreases.

In *Cladrastis* the seeds were classified not merely according to the number produced in the pod, but according to their position in the pod, the positions being numbered from the proximal to the distal end. Table VI. gives the results. When only one seed is produced the mean weight is higher than when the pod contains two or more. There is no essential difference between 2- and 3-seeded pods. Within a pod containing 2–4 seeds the mean weight decreases from the proximal towards the distal position.

TABLE VI

Seeds per Pod	Position of Seed in Pod				
	1	2	3	4	All
1	($N=500$) .03385				($N=500$) .03385
2	($N=500$) .03267	($N=500$) .03134			($N=1000$) .03201
3	($N=100$) .03257	($N=100$) .03183	($N=100$) .03163		($N=300$) .03201
4	($N=22$) .03209	($N=22$) .03086	($N=22$) .03013	($N=22$) .02945	($N=88$) .03064

The weights could not be determined for the seeds individually to allow of obtaining the probable errors which are much needed where differences so slight as those given here are involved. They were weighed in groups of 25, and when these individual samples from different kinds of pods or positions are compared, the results emphasize the general trustworthiness of the conclusions drawn above.

The exact degree of interdependence between number of seeds per pod or position of the seed in the pod and seed weight cannot be determined from this series of data since the variability in seed weight is unknown.* It is evident, however, that in the absolute size of seed only very slight (although definite) differences are referable to characteristics of the pod. I think that *a priori* physiologists would have expected greater differences.

COLD SPRING HARBOR, L. I.,
July 14, 1911.

* Data for another species in which this point has been determined are now in hand.

LOCAL FLORA NOTES—IX

BY NORMAN TAYLOR

Species	*Specimens wanted from*
	ROSACEAE
Spiraea tomentosa L.	Anywhere on the coastal plain.
S. salicifolia L.	Anywhere in the range.*
S. alba Du Roi.	Anywhere in the range.
S. corymbosa Raf.	Known in New Jersey?
Aruncus allegheniensis Rydb.	Mountains of Pennsylvania.
Porteranthus trifoliatus (L.) Britton.	Pennsylvania and central New Jersey.
Potentilla pumila Poir.	Anywhere above 1,000 ft.
P. simplex Michx.	The region northwest of the "fall-line."
Comarum palustre L.	Anywhere in the range.
Fragaria canadensis Michx.	Mountains of Pennsylvania.
F. americana (Porter) Britton.	New Jersey.
Sibbaldiopsis tridentata (Soland.) Rydb.	Below 1,000 ft. elevation.
Dasiphora fruticosa (L.) Rydb.	The Catskills or northern New Jersey.
Drymocallis agrimonioides (Pursh) Rydb.	Northern New Jersey.
Sanguisorba canadensis L.	North of the "fall-line."
Rubi	The Catskills and northern Pennsylvania.†
Dalibarda repens L.	Below 1,000 ft. elevation.

* The local flora range as prescribed by the Club's Preliminary Catalogue of 1888 is as follows: All of the state of Connecticut; Long Island; in New York the counties bordering the Hudson River up to and including Columbia and Greene, also Sullivan and Delaware counties; all of New Jersey; and Pike, Wayne, Monroe, Lackawanna, Luzerne, Northampton, Lehigh, Carbon, Bucks, Berks, Schuylkill, Montgomery, Philadelphia, Delaware and Chester counties in Pennsylvania.

† In the genus *Rubus* material is also needed from throughout the range to aid in determining, not only the perplexed question of hybridity, but also to ascertain if possible endemisms in this difficult group, are not rather common.

Species	*Specimens wanted from*
Waldsteinia fragarioides (Michx.) Tratt.	Orange, Sullivan and Delaware counties, N. Y.
Agrimonia pumila Muhl.	Chester Co., Pa.
A. Brittoniana Bicknell.	Below 1,000 ft. elevation.
A. parviflora Soland.	Anywhere in the mountains.
Rosa blanda Ait.	The south shore of L. I. and from N. J.
R. canina L.	Anywhere in the range. How extensively naturalized?
R. humilis Marsh.	See footnote.*
POMACEAE	
Sorbus americana Marsh.	Below 1,000 ft. elevation.
Pyrus communis L.	Is it anywhere an established escape?
Malus coronaria (L.) Mill.	From the Hudson and Delaware valleys.
M. angustifolia (Ait.) Michx.	Anywhere in the range.
M. Malus (L.) Britton.	Is the apple an established escape?
Aronia nigra (Willd.) Britton.	The coastal plain region.
A. atropurpurea Britton.	See footnote.†
Amelanchier sanguinea (Pursh) Lindl. (*A. rotundifolia*).	Northern New Jersey and the mountains of Pennsylvania.
Crataegi	Species from the limestone regions of New York and New Jersey. Also from the serpentines of Pennsylvania.

* A form of *Rosa humilis* obviously not the variety *villosa* merits attention from local flora enthusiasts. It has very much larger flowers than the typical form, and its petals are extremely fugacious. Specimens have been collected near Farmingdale, N. J., and recently from near Spring Valley, N. Y. Otherwise the plant is unknown, at least in herbaria.

† A somewhat critical species, said to differ from our common *A. arbutifolia* in having oval to globose, purple-black fruits rather than short-pyriform, bright red ones. The difficulty of distinguishing such characters in dried specimens is obvious. Material is needed, particularly with accurate notes on color and form of fruit, from anywhere in the range.

Species	*Specimens wanted from*
	DRUPACEAE
Padus (*Prunus*) *virginiana* (L.) Roem.	The coastal plain.
Prunus americana Marsh.	Northern New Jersey.
P. cuneata Raf.	Westchester Co., N. Y.
Prunus maritima Wang.	See footnote.*
P. Gravesi Small.	Long Island, Staten Island or the coastal region of N. J.
P. angustifolia Marsh.	North of Salem Co., N. J.
P. alleghaniensis Porter.	Between New Jersey and Connecticut.
P. pennsylvanica L. f.	Below 1,000 ft. elevation in N. Y. or N. J.
P. pumila L.	Long Island or Staten Island.
	CAESALPINACEAE
Cercis canadensis L.	Anywhere in the range as a true wild plant.
Cassia marylandica L.	Northern N. J., N. Y., and Pa.
C. Chamaecrista L.	North of the coastal Xlain.
C. nicticans L.	The Catskills or the mountains of Pennsylvania.
	PAPILIONACEAE
Meibomia ochroleuca (M. A. Curtis) Kuntze.	North of Salem Co., N. J.
M. glabella (Michx.) Kuntze.	Passaic, Sussex, or Warren counties, N. J.
M. sessilifolia (Torr.) Kuntze.	Long Island or New Jersey.

* The beach plum, often almost a tree along the coast, becomes a mere straggling shrub inland. It is known from near New Egypt, Ocean Co., N. J., from West Point, N. Y., and from near Bordentown on the Delaware. Special interest attaches to the occurrence of this maritime plant inland, and any specimens from inland localities, together with notes as to its proximity to streams, will be welcome. It is known from a number of stations in the pine-barrens, which are perhaps explainable by the peculiar geological history of that region.

Species	*Specimens wanted from*
M. stricta (Pursh) Kuntze.	Middlesex or Mercer counties, N. J.
M. laevigata (Nutt.) Kuntze.	Somerset or Warren Counties, N. J.
M. obtusa (Muhl.) Vail.	North of the coastal plain.
Cytisus scoparius (L.) Link.	From anywhere in the range.[1]
Trifolium carolinianum Michx.	Near Philadelphia, Trenton or Bordentown.
Amorpha fruticosa L.	Luzerne or Schuylkill counties, Pa., as a wild plant.
Astragallus carolinianus L. (*A. canadensis*).	Northern New York or New Jersey.
Stylosanthes biflora (L.) B.S.P.	Northern shore of Long Island.
Lespedeza Brittonii Bicknell.	Anywhere in the range.
L. simulata Mackensie & Bush.	See footnote[2].
Lespedeza angustifolia (Pursh) Ell.	Long Island or Staten Island.
Vicia americana Muhl.	Anywhere in the range.
V. caroliniana Walt.	In the Hudson Valley.
Lathyrus palustris L.	Anywhere in the range.[3]
L. venosus Muhl.	Central and northern N. J.
L. maritimus (L.) Bigel.	Anywhere away from the coast.[4]
Bradburya virginiana (L.) Kuntze.	North of Ocean Co., N. J.

[1] Very rarely becoming thoroughly naturalized in our range. A large mass of it, apparently persisting for many years, was recently discovered growing luxuriantly in the grounds of the Brooklyn Botanic Garden.

[2] A plant only recently known as from the range. In the Connecticut Botanical Club's list of the plants of that state it is reported from Groton and Southington. Mr. K. K. Mackenzie has also collected it at Haworth, Bergen Co., N. J. The plant is otherwise unknown from the area.

[3] Apparently isolated, so far as our specimens show, at a single station in New Jersey. It is supposed to be in New York but no records are extant. The New Jersey specimen is peculiar as it was taken from an "island" of shrubs and trees completely surrounded by salt marsh.

[4] The farthest inland record of this sea-beach plant is White Plains, Westchester Co., N. Y. Any further inland extension of the range would be interesting.

Species	*Specimens wanted from*
Clitoria Mariana L.	Middlesex Co., N. J.
Galactia volubilis (L.) Britt.	New Jersey.

BROOKLYN BOTANIC GARDEN.

SHORTER NOTES

A SECOND SPECIES OF HERNANDIA IN JAMAICA.—The discovery of a species of *Hernandia* in the western part of the island of Jamaica, some years ago,* the existence of the genus in that island having been in doubt for many years, was of much interest, and the more recent finding of a second species in the mountainous parts of the eastern end of the island is of no less. This tree may be described as follows:

Hernandia catalpifolia Britton & Harris sp. nov.

A tree, up to 16 meters high, the trunk straight, rather widely branched above the middle. Leaves broadly ovate, chartaceous, puberulent when young, becoming glabrous, strongly 5-nerved from the rounded or subtruncate base, short-acuminate at the apex, 2 dm. long or less, not at all peltate, the stout petiole nearly as long as the blade; panicles ample, convex, often broader than long, their branches divaricate-ascending, slender, puberulent; involucral bracts oblong, obtusish; sepals white, oblong, obtuse, 5 mm. long; fruit subglobose, 2 cm. long.

Mountain woodlands, Parish of St. Thomas, Jamaica (*Harris and Britton 10.588*, *type; 10.566; 10.685; Britton 4061*).

This is probably the tree referred from Jamaica by previous authors to *H. Sonora* L., of Porto Rico and the Lesser Antilles, which has peltate leaves, somewhat larger flowers and larger fruit.

N. L. BRITTON.

STANGERIA OR STANGERA, AND STANGERITES OR STRANGERITES? TWO QUESTIONS OF NOMENCLATURE.—In T. Moore's "List of Mr. Plant's Natal Ferns" (Hook. Journ. Bot. and Kew Gard.

* Bull. Torrey Club **35**: 338. 1908.

Miscellany **5**: 225–229. 1853), on page 228, may be found a description of a new genus, *Stangeria*, named in honor of Dr. Stanger.* Subsequently Stevens altered the spelling of the name to *Stanggeria* (Proc. Linn. Soc. **2**: 340. 1854) and, later still, A. Voss changed it to *Stangera* ("Vilmorin's Blumengärtnerei" ed. 1. **3**: 1244. 1896).

Stevens' name, *Stanggeria* has, of course, no standing in nomenclature and need not be further considered; but the question may possibly be raised whether *Stangera* Voss should be substituted for *Stangeria* Moore?

A somewhat similar question also arises in connection with the fossil genus *Strangerites* Borneman ("Ueber Organische Reste der Lettenkohlengruppe Thüringens" 59. 1856), which he founded to include certain hitherto supposed fossil ferns, with the expressed intention of indicating, in the name, their probable relationship to the genus *Stangeria*. The spelling of his new generic name was so obviously due either to carelessness or to a typographical error that, apparently, all subsequent writers ignored it, beginning with Oldham and Morris ("Paleont. Indica, Foss. Fl. Rajmahal Ser." 32. 1862), who wrote it *Stangerites*, but credited it, in the amended form, to Borneman.

The question is, therefore, whether *Stangerites* Oldham and Morris should be substituted for *Strangerites* Borneman, or whether the latter name should be regarded as representing a typographical error and be corrected to *Stangerites* Borneman?

ARTHUR HOLLICK.

* One species, *paradoxa*, was included in the genus, and this specific name, also, has an interesting history. The species was known to other botanists previous to the date of Moore's publication and was generally regarded as a fern, the fructification not having been found and the nervation of the leaves (pinnately arranged and forking) strongly suggesting a fern rather than a cycad. G. Kunze (Linnaea **10**: 506. 1836) referred it to *Lomaria coriacea* Schrad., but later (*Ibid.* **13**: 152. 1839) described it as a new species under the name *L. eriopus*. Moore appears to have been the first to suspect that it might be a cycad and says (*loc. cit.*) that it "would seem to be either a fern-like *Zamia* or a zamia-like fern," and renamed it *Stangeria paradoxa*. Subsequent discovery of the fructification proved that Moore's suspicions were well founded and that it was a cycad and not a *Lomaria*. Kunze's specific name, however, having priority over that of Moore, required that the latter be dropped and the binomial *Stangeria eriopus* be adopted (Nash, Journ. N. Y. Bot. Gard. **9**: 202. 1908; **10**: 164. 1909).

REVIEWS

Some Recent University of California Publications*

The first ten numbers of volume 4 of the "University of California Publications in Botany" represent a considerable variety as to subject matter, with, however, a decided preponderance, so far as the titles are concerned, of papers relating to the marine algae of the Pacific Coast.

Dr. H. M. Hall's "Studies in ornamental trees and shrubs" includes descriptions and illustrations of some of the more common and desirable of the cultivated ornamental trees and shrubs of California. There is probably no state in the Union in which cultivated, largely exotic, trees and shrubs are relatively so conspicuous to the casual visitor, at least, as in California, and any paper that assists in their identification will be welcomed by many. The species treated are largely of Australian and New Zealand origin and many are of the genera *Pittosporum*, *Hakea*, *Callistemon*, and *Melaleuca*. The species of *Eucalyptus*, of which about 100 are said to be cultivated in California, are omitted, whether because they are not considered sufficiently ornamental or because they are held to be adequately treated elsewhere

* Hall, H. M. Studies in ornamental trees and shrubs. Univ. California Publ. Bot. 4: 1–74. *pl. 1–11* + *f. 1–15*. 19 Mr 1910.

Wilson, H. L. *Gracilariophila*, a new parasite on *Gracilaria confervoides*. *Loc. cit.* 4: 75–84. *pl. 12, 13*. 26 My 1910.

Brandegee, T. S. Plantae Mexicanae Purpusianae, II. *Loc. cit.* 4: 85–95. 26 My 1910.

Gardner, N. L. *Leuvenia*, a new genus of flagellates. *Loc. cit.* 4: 97–106. *pl. 14*. 26 My 1910.

Setchell, W. A. The genus *Sphaerosoma*. *Loc. cit.* 4: 107–120. *pl. 15*. 26 My 1910.

Gardner, N. L. Variations in nuclear extrusion among the Fucaceae. *Loc. cit.* 4: 121–136. *pl. 16, 17*. 26 Au 1910.

McFadden, A. S. The nature of the carpostomes in the cystocarp of *Ahnfeldtia gigartinoides*. *Loc. cit.* 4: 137–142. *pl. 18*. 25 F 1911.

McFadden, M. E. On a *Colacodasya* from southern California. *Loc. cit.* 4: 143–150. *pl. 19*. 25 F 1911.

Hoffman, E. J. Fructification of *Macrocystis*. *Loc. cit.* 4: 151–158. *pl. 20*. 25 F 1911.

Twiss, W. C. *Erythrophyllum delesserioides* J. Ag. *Loc. cit.* 4: 159–176. *pl. 21–24*. 8 Mr 1911.

seems not to be definitely stated by the author. Presumably, however, the implication of incompleteness in the modest title is a sufficient explanation of the absence of the eucalyptus and certain others.

Harriet L. Wilson's paper on "*Gracilariophila*, a new parasite on *Gracilaria confervoides*" describes the structure and development of a small red alga that is parasitic on a larger red alga to which it appears to be closely related. The parasite forms on the surface of the *Gracilaria* colorless tubercles resembling adherent particles of sand or small grains of rice. Three sorts of tubercles, antheridial, cystocarpic, and tetrasporic, distinguishable from each other only under the microscope, occur. Rhizoidal processes penetrate the host plant and evidently serve not only for attachment but for drawing nourishment from the host. The parasite is described as *Gracilariophila oryzoides* Setchell & Wilson, new genus and species, and is referred to the same suborder to which its host belongs.

In "Plantae Mexicanae Purpusianae, II," Mr. T. S. Brandegee describes twenty-two new species of spermatophytes, nearly all collected by Dr. C. A. Purpus in the state of Puebla, near the boundary line of Oaxaca, Mexico. One of the species represents a new genus, *Amphorella*, of the Asclepiadaceae.

Dr. N. L. Gardner, in his paper on "*Leuvenia*, a new genus of flagellates," describes and figures in much detail the structure and development of a curious microscopic fresh-water organism, the affinities of which are uncertain. Specimens of the organism had been distributed in the Phycotheca Boreali-Americana under the name *Osterhoutia natans*, but, learning that the name *Osterhoutia* had been previously given to a genus of spermatophytes, Dr. Gardner avails himself of another one of Professor W. J. Van Leuven Osterhout's names in coining the substitute generic name *Leuvenia*.

Professor Setchell, as would appear from his paper on "The genus *Sphaerosoma*," was led by a study of a Californian ascomycetous fungus, at first supposed to be an undescribed species of *Sphaerosoma*, to a critical review of the pertinent literature and the available specimens referred to this genus. Among his

results are the restriction of the generic name *Sphaerosoma* to two (or three?) already published European and American species and the description of the Californian plant as *Ruhlandiella hesperia* sp. nov.

Dr. N. L. Gardner's paper on "Variations in nuclear extrusion among the Fucaceae" sets forth the results of a study of the formation of the oöspheres in the commoner Californian representatives of the rockweed family. Decaisne and Thuret, in a paper published in 1845, were pioneers in a comparative study of the number of oöspheres to an oögonium in the Fucaceae, and as one of the results of their researches defined four genera having their respective numbers of oöspheres in a beautiful geometrical series: *Cymaduse* (= *Bifurcaria*) with one oösphere to the oögonium, *Pelvetia* with two, *Ozothallia* (= *Ascophyllum*) with four, and *Fucus* with eight. Gardner finds that some of the Californian Fucaceae do not fit into this scheme very well. In the plant that has been known as *Fucus Harveyanus* eight nuclei are formed by divisions of the original oögonium nucleus, but only two oöspheres are developed; these are of very unequal size, the larger containing a single large nucleus and the smaller seven small nuclei. It is presumed that only the larger oösphere is capable of fertilization. Chiefly on these grounds, *Fucus Harveyanus* is considered the type of a new genus *Hesperophycus* Setchell & Gardner. In a somewhat similar way, while the typical *Pelvetia fastigiata* of California agrees essentially with the European *Pelvetia canaliculata* in forming two practically equal oöspheres to an oögonium, the plant that has been known as *Pelvetia fastigiata* forma *limitata* Setchell produces two very unequal oöspheres, which had led to assigning it to a new genus *Pelvetiopsis* Gardner. These results suggest to the reviewer the possibility that similar accurate investigations of the number and character of the oöspheres of the remaining Fucaceae of the world might lead to discovery of grounds for several other similar generic segregations and that a large number of genera thus based might prove rather impracticable and unnatural. But there is scarcely more ground for disputing about genera than about tastes and it would certainly be premature to venture any

very positive judgment in the matter until the facts in the case are all known.

The title of Ada Sara McFadden's paper "The nature of the carpostomes in the cystocarp of *Ahnfeldtia gigartinoides*" gives a fair idea of the subject matter of her brief dissertation. The peculiar openings of the cystocarp of this marine red alga are said to average as many as forty-two to a cystocarp. They are possibly formed by decomposition. Incidentally, the author sets forth the ample grounds for considering the Pacific American *Ahnfeldtia gigartinoides* specifically distinct from *Ahnfeldtia concinna*, originally described from Hawaii.

In continuation of the notable studies of parasitic red algae being made at the University of California, Mabel Effie McFadden publishes as her thesis for the degree of master of science a paper "On a *Colacodasya* from southern California." The paper is devoted to describing and figuring *Colacodasya verrucaeformis* W. A. Setchell and M. E. McFadden, sp. nov., parasitic on *Mychodea episcopalis* J. Ag. This parasite was first detected by Professor W. G. Farlow, but the description is based on abundant material collected later at San Pedro by Dr. N. L. Gardner.

Edna Juanita Hoffman, in her account of the "Fructification of *Macrocystis*," describes the character of the fertile leaves and the nature of the sori of Californian and Peruvian specimens of the Great Kelp—*Macrocystis pyrifera*. In Californian plants the sporangia occur on basal leaves differing from the upper leaves in the absence of bladders or in the possession of a branching blade. In Peruvian specimens collected by D. G. Fairchild in 1899, sori are found on leaves of about the ordinary type. In neither do the reproductive bodies occur in "furrows," as described in 1895 by Misses Smith and Whitting.

The main results of the study of "*Erythrophyllum delesserioides* J. Ag." by Mr. Wilfred Charles Twiss is that the plant belongs among the Gigartinaceae, where originally placed by J. Agardh, instead of among the Dumontiaceae to which it was doubtfully referred by Schmitz in "Die natürlichen Pflanzenfamilien" of Engler and Prantl. Mr. Twiss thus confirms the opinion ex-

pressed by Professor Setchell in 1899 in distributing mature specimens of *Erythrophyllum* in the Phycotheca Boreali-America. It appears that *E. delesserioides* J. Ag. (1871) was based upon a fragment of a young sterile plant, while the later *Polyneura californica* J. Ag. (1899) was described from older, mostly fertile, representatives of the same species. MARSHALL A. HOWE.

NEWS ITEMS

Professor W. Johannsen of the University of Copenhagen is to give in October and November a course of lectures and seminar conferences on "Modern Conceptions of Heredity," at Columbia University. These will be under the joint auspices of the departments of botany and zoölogy, and will consist of four public lectures on October 13, 20, 27, and November 3. Eight seminars of a more technical nature will be open to a limited group of investigators. The latter will be more fully announced later.

Dr. F. J. Collins has resigned as assistant professor of botany at Brown University to accept a position in the Bureau of Plant Industry as forest pathologist.

Miss Jean Broadhurst of Teachers College, and manager of the department "Of Interest to Teachers" in TORREYA, is spending the summer in England. Dr. Philip Dowell, editor of the BULLETIN, is at the United States National Herbarium.

At the New York Botanical Garden the following lectures will complete the summer course: August 12, "The Paris Botanical Garden," by W. A. Murrill; August 19, "A Visit to the Panama Canal Zone," by M. A. Howe; August 26, "Evergreens: Their Uses in the Landscape," by G. V. Nash.

The Brooklyn Institute Museum herbarium has recently unearthed from storage several thousand sheets of material dating all the way from 1818 to 1876. These specimens are now mounted and will soon be incorporated in the regular series of the herbarium. It is worthy of note that some of this was collected by Torrey, Cooper, and L. C. Beck.

Dr. N. L. Britton, director of the New York Botanical Garden, sailed for Europe on August 9, to continue studies on the West Indian flora.

TORREYA

September, 1911

Vol. 11 No. 9

GERMINATION OF CAT-TAIL SEEDS

By E. L. Morris

Those who roam afield in the fall, especially along marshes, have often seen the masses of down and seeds which so freely scatter from the cat-tail heads at any shock. Nature's commonest way of scattering these seeds, of course, is the force of the wind, either in actually blowing the seeds from the head or so shaking the plants that the seeds are lost out. The point of this paragraph is, however, the sprouting of the seeds while still in position in the cat-tail head. About the time of seed ripening this particular head must have been broken off until it just touched the ground, and, in the unusually dry spring of this year, the seeds failed to germinate. The early summer rains raised the water level of the marsh sufficiently to keep the fruiting head entirely moistened and, with the direct sun pouring down, the conditions became proper for the seeds to sprout. As shown in the illustration, they sprouted from the surface of the head then uppermost. Looking closely, one sees that the axis of each seedling is bent into the characteristic elbow for protrusion from the seed coat. At the time of taking, a few of the elbows had straightened out and the primary root had begun to grow through the mass of bristles into the wet soil on which the head lay. At this time, each of the seedlings was probably only a day or two old, as is indicated by the nearly uniform size of all the seedlings, none seeming to have had an advantage over the others, and the fact that the most of them were still in the "elbow stage." This specimen was collected in a swamp beside the track a few rods west of the Valley Stream station of the Long Island Railroad. The measurements of these seedlings at the time of taking were 8–10 mm.

[No. 8, Vol. 11, of Torreya, comprising pp. 165–180, was issued 14 August 1911.]

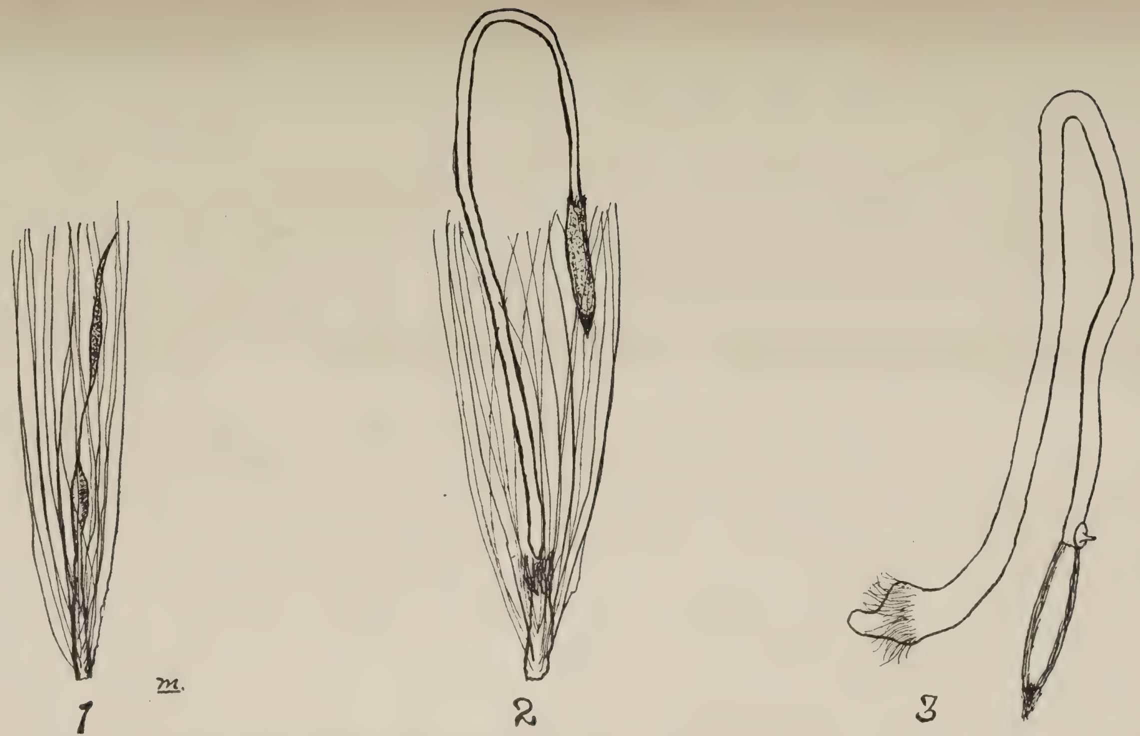

FIG. 2. 1. Unfertilized pistillate flower. 2. Germinated seed protruding from the macerating flower. 3. Seedling. (*Typha augustifolia* L.)

Corresponding germination of seeds, still within the ripe head of the parent plant, is not particularly common unless unusually favorable conditions for germination exist under which the heads are, through some abnormal circumstance, held captive. Such a case is shown by specimens in our collection of the heads of the common burdock.

Museum of the Brooklyn Institute
of Arts and Sciences

THE FERTILIZATION OF THE EEL-GRASS

[The availability of the subjoined extract for Torreya has been a matter of considerable speculation and not a little misgiving. It is one of thirty diminutive essays, all in a similar vein, and all highly charged with the imaginative poetry of the greatest of our modern mystic poets. The editor would have had little misgiving if the acceptance of the "botany" of this excerpt were as sure as its instant recognition as literature of a particularly charming style. Doubtless there are botanists who will question the writer, with a degree of vehemence measured by their antipathy to things of the imagination, when applied to their chosen science. But whatever of alleged "nature-faking" the unbeliever thinks he reads into the paragraphs below, it were well to remember that the writer, except for a trivial error, enclosed in square brackets, is perfectly correct as to his facts, and that it is only with his interpretation of them that one has any true quarrel. And it is precisely at these interpretative features of the essay that many botanists will become most excited. Not a few will immediately wax expansive over the perfectly irrelevant commonplace that plants do not "feel," nor "see," nor do a score of things that an imaginative writer may credit them with doing. All the while forgetting, that by the exercise of his imagination, a writer with a somewhat different perspective from that of the average botanist, may so change the point of view, so visualize the every-day, common thing, that the reader will never quite look at it with his customary indifference; never quite put it into the category of those in-

teresting things that nearly everyone forgets. It is just this quality of forever fixing in one's mind the fertilization of *Vallisneria* that has made the printing of this essay a privilege.

N. T.]

"We must not leave the aquatic plants without briefly mentioning the life of the most romantic of them all: the legendary *Vallisneria*, an hydrocharad whose nuptials form the most tragic episode in the love-history of the flowers. The *Vallisneria* is a rather insignificant herb, possessing none of the strange grace of the water-lily or of certain submersed verdant plants. But it seems as though nature had delighted in giving it a beautiful idea. Its whole existence is spent at the bottom of the water, in a sort of half-slumber, until the wedding-hour comes, when it aspires to a new life. Then the female plant slowly uncoils the long spiral of its peduncle, rises, emerges, and floats and blossoms on the surface of the pond. From a neighboring stem, the male flowers, which see it through the sunlit water rise in their turn, full of hope, towards the one that rocks, that awaits them, that calls them to a fairer world. But when they have come halfway, they feel themselves suddenly held back: their stalk, the very source of their life, is too short; they will never reach the abode of light, the only spot in which the union of the stamens and pistils can be achieved!"

"Is there any more cruel inadvertance or ordeal in nature? Picture the tragedy of that longing, the inaccessible so nearly attained, the transparent fatality, the impossible with not a visible obstacle! It would be insoluble, like our own tragedy upon this earth, were it not that an unexpected element is mingled with it. Did the males foresee the disillusion to which they would be subjected? One thing is certain, that they have locked up in their hearts a bubble of air, even as we lock up in our souls a thought of desperate deliverance. It is as though they hesitated for a moment; then with a magnificent effort, the finest, the most supernatural that I know of in all the pageantry of the insects and the flowers, in order to rise to happiness they deliberately break the bond that attaches them to life. They tear themselves from their peduncle and, with an incom-

parable flight, amid bubbles of gladness, their petals dart up and break the surface of the water. Wounded to death, but radiant and free they float for a moment beside their heedless brides and the union is accomplished, whereupon the victims drift away to perish, while the wife, already a mother, closes her corolla [calyx], in which lives their last breath, rolls up her spiral and descends to the depths, there to ripen the fruit of the heroic kiss." [From Maurice Maeterlinck's essay on the "*Intelligence of the Flowers*" in "*The Measure of the Hours*." Dodd, Mead & Co., 1910.]

LOCAL FLORA NOTES—X

By Norman Taylor

Species	*Specimens wanted from*
	Geraniaceae
Geranium Robertianum L.	The coastal plain.
G. sibiricum L.	Established in the range?*
G. pusillum Burm.	New York or northern New Jersey.
G. Columbianum L.	Pennsylvania
G. Bicknellii Britton.	Anywhere in the range.
G. Pyrenaicum L.	Is it known in the range?
Erodium cicutarium (L.) L'Her.	Northern New York or New Jersey.
	Oxalidaceae
Oxalis Acetosella L.	Below 1000 ft. elevation.
O. Bushii Small.	New Jersey.
O. rufa Small.	Anywhere in the range.
O. stricta L.	Above 1000 ft. elevation.

* The local flora range as prescribed by the Club's Preliminary Catalogue of 1888 is as follows: All of the state of Connecticut; Long Island; in New York the counties bordering the Hudson River up to and including Columbia and Greene, also Sullivan and Delaware counties; all of New Jersey; and Pike, Wayne, Monroe, Lackawanna, Luzerne, Northampton, Lehigh, Carbon, Bucks, Berks, Schuylkill, Montgomery, Philadelphia, Delaware and Chester counties in Pennsylvania.

Species	*Specimens wanted from*
	LINACEAE
Linum humile Mill.	Is it an escape?
L. grandiflorum Desf.	Is it established in the range?
L. striatum Walt.	The Hudson Valley.
L. floridanum (Planch) Trelease.	New York or New Jersey.*
L. medium (Planch) Britton.	North or northwest of the coastal plain.
L. sulcatum (Riddell) Small.	Northern New York or New Jersey.
	ZYGOPHYLLACEAE
Tribulus terrestris L.	Anywhere in the range.†
	RUTACEAE
Zanthoxylum americanum L.	From the coastal plain region of New Jersey.
Ptelea trifoliata L.	Anywhere in the range.
	POLYGALACEAE
Polygala lutea L.	Long Island or Staten Island.
P. brevifolia Nutt.	Long Island.
P. incarnata L.	New Jersey, particularly in the pine-barrens.
P. Curtissii A. Gray.	Anywhere in the range.‡
P. Mariana Mill.	Pine-barrens of New Jersey.
P. Senega L.	Anywhere in the range.§
P. paucifolia Willd.	The northern part of the range.

* This unfamiliar plant is now known from two stations on Long Island but not otherwise known from the range.

† Three stations are represented by specimens and there seems a fair chance of this plant becoming established in waste places.

‡ Perhaps not distinct from *P. viridescens* L. Supposed to be in Pennsylvania and doubtfully in New Jersey, but no specimens are extant from the range that can unhesitatingly be placed here.

§ The form described as *latifolia* is also unknown in our area.

Species	*Specimens wanted from*
	EUPHORBIACEAE
Phyllanthus carolinensis Walt.	Anywhere in the range.*
Croton capitatus Michx.	Anywhere in the range.
Crotonopsis linearis Michx.	Eastern Pennsylvania and adjacent New Jersey.
Acalypha gracilens A. Gray.	New Jersey or New York.
A. ostryaefolia Ridd.	Middlesex or Somerset counties, New Jersey.
Euphorbia glyptosperma Engelm.	New York or northern New Jersey.
E. humistrata Engelm.	Anywhere in the range.
E. corollata L.	Middlesex, Mercer, or Monmouth counties, New Jersey.
E. marginata Pursh.	Is it established as an escape?
E. dentata Michx.	Pennsylvania or New Jersey.
E. Ipecacuanhae L.	In sand north or west of the "fall line."
E. Darlingtonii A. Gray.	Southern New Jersey.
E. commutata Engelm.	Anywhere in the range.
E. lucida L.	New Jersey and Pennsylvania.
	CALLITRICHACEAE
Callitriche Austinii Engelm.	Long Island or Westchester Co., New York.
	EMPETRACEAE
Corema Conradi Torrey.	The northern part of the pine-barrens.
	LIMNANTHACEAE
Floerkea proserpinacoides Willd.	Northern New York or from Sussex County, New Jersey.

* Credited to the range in the Club's Preliminary Catalogue of 1888, but otherwise unknown. Reported from eastern Pennsylvania.

Species	*Specimens wanted from*
	ANACARDIACEAE
Rhus aromatica Ait.	Anywhere in the range.
R. hirta (L.) Sudw.	Northern New Jersey.
Ilex opaca Ait.	Long Island; as a wild plant from Connecticut.
I. monticola A. Gray.	Mountains of New York or New Jersey.
I. glabra (L.) A. Gray.	Long Island.
I. bronxensis Britton.	See footnote.*
Illicoides mucronata (L.) Britton.	The coastal plain region.
	CELASTRACEAE
Euonymus americanus L.	North or west of the coastal plain.
	ACERACEAE
Acer pennsylvanicum L.	South of the highlands of the Hudson.
A. spicatum Lam.	In Westchester Co., New York, or in northern New Jersey.
A. carolinianum Walt.	See footnote.†
A. nigrum Michx.	Anywhere in the range.

* A species very doubtfully distinct from *I. verticillata;* originally described from near Woodlawn, N. Y. City. Said to differ from the common plant by obovate instead of oblong or oval leaves, and by its orange-red instead of scarlet fruits. Dr. Britton has recently expressed grave doubts as to the specific validity of *Ilex bronxensis*.

† The pine-barren and southern New Jersey form of the common red maple. It is known from as far north as Spotswood, Middlesex Co., N. J., but no farther. Are any records extant indicating its extreme northern limits?

BROOKLYN BOTANIC GARDEN.

REVIEWS

Harshberger's Phytogeographic Survey of North America*

This long expected work on North American plant geography by Professor Harshberger has at last appeared under date of 1911. The writer has divided his work into four parts, and for purposes of review, it will be convenient to consider these divisions in their proper order; reserving for the end some general conclusions.

I. History and Literature of the Botanic Works and Explorations of the North American Continent. To this historical first chapter (pp. 1–39), dealing with the rise and development of North American floristic botany, much might still be added, and then one would continue to feel the inadequacy of the treatment. For instance, the failure to mention Fernald's work in the Gaspé peninsula (p. 4), Rydberg's on the Canadian Rockies (p. 5), or of Hollick's explorations in Alaska (p. 7) all leave something to be desired in an essay on the history of Canadian and northern botany. Coming down to New England, a fairly comprehensive survey of botanical activity in that section is given, stretching from John Josselyn's "New England Rarities," 1672, to the work of Robinson and Fernald, of our own times. In a book the preface of which is dated October, 1910, one would have hoped to find some mention of the recent admirable catalog of Connecticut plants, issued early in 1910, by the Connecticut Botanical Club, but the author does not seem to have known of it, or perhaps not soon enough to get it into his work.

It is in covering the Middle Atlantic States that we should expect the historical portion of this work to be the most precise and of greatest value, as it is here that the records of over a hundred years are rich and varied. Tracing the early period of Green, LeConte, Hosack, and Torrey down to the mid-nineteenth

* Harshberger, J. W. Phytogeographic Survey of North America. A consideration of the phytogeography of the North American continent, including Mexico, Central America and the West Indies, together with the evolution of North American plant distribution. Pp. i – lxiii + 1 – 790. Pl. I – XVIII + f. 1 – 32, and colored map. William Engelmann, Leipzig, and G. E. Stechert, New York. Price, unbound, $13.00. [Vol. XIII. Die Vegegation der Erde, A. Engler and O. Drude.

century, the writer then takes up more recent developments No mention is made of the very intimate relations between the Torrey Club and the New York Botanical Garden (not "Botanic Museum"), and of the fact that the president of the former must *ipso facto* be on the board of managers of the latter. That the Bronx Garden owes its very existence to a movement started in the Club many years ago is a well known piece of historical gossip. His treatment of the Garden itself and of the Club also, is somewhat inadequate, as no mention is made of the work of Murrill, or Hollick, at the former; and it were pertinent to remind the writer that there have been two editors of the *Bulletin* since Dr. Barnhart resigned some years ago as editor-in-chief of the Club. Of a more serious nature is the omission of any mention of the comparatively important floras of Utica, by Harberer, and of Troy, by Wright and another by Eaton; and the inclusion of the inconsequential little pamphlet on the flora of Central Park, New York City, by E. A. Day! Similarly, the failure to mention the work of Stewardson Brown and Miss Keller, on the flora of the vicinity of Philadelphia, is somewhat surprising.

E. L. Greene's work on the flora of the Rocky Mountains, and Nelson's recent book on that subject (p. 23), are also ignored. Again, Rydberg, in his flora of Montana and the Yellowstone does something more than "give an account of the herbaria consulted, the botanists engaged in field work, and the localities visited." This information is confined to the preface, whereas in the body of the work are such data as a catalog of the plants, with stations cited, together with habitats, altitudinal distribution, etc. Notwithstanding editorial curtailment of space, we should have expected to see mention, at least causally, of the work of LeRoy Abrams in California, of Transeau, Shreve, Cannon and Lloyd in Arizona, and of Von Turckheim and perhaps Wercklé in Central America.

It must not be inferred from this catalog of things and names omitted from the history that the work is not without much value, for it is something to have brought together the imposing array of facts and names that Dr. Harshberger has accumulated

and there is presented a fairly comprehensive history of floristic botany in this country so far as its broad outlines are concerned.

A rather meager account of the history of plant geography, physiography, altitudinal distribution, and phenology is perhaps to be accounted for. These subjects lend themselves to historical treatment with difficulty, and the obvious scantiness of the data must be accepted as an excuse for the all too brief record (7 pages) that the author has set down.

There follows then, in chapter two (pp. 45–92), a bibliography of North American Botany, separated into (*a*) general works, and (*b*) special works on the territories; the latter under the eight sectional divisions into which Dr. Harshberger has divided the continent. Each of these parts of the bibliography is alphabetic-chronologic in arrangement, and it is the latter feature of the lists that attracts instant attention. All, or nearly all, the important works are listed up to 1908; from then onwards one finds nothing. The bringing of a bibliography only up to within nearly three years of the date of publication is open to some question, at least, as to timeliness; but the failure to list later and more complete editions of old works is positively misleading to the seeker after bibliographic facts, who has reason to expect approximate completeness, at least up to 1908. A case well illustrating this is the citation, both in the bibliography and throughout the rest of the book, of Gannett's Dictionary of Altitudes of the United States as Bulletin 160 of the U. S. Geological Survey, 1899, when a new edition, nearly twice as large, was published in 1906 as bulletin 274 of the same series.

Many minor inaccuracies are to be found, such as the date of Grisebach's Flora of the British West Indies. It is given as 1864, when it is a well known fact that the work appeared in six parts, five of which were issued before the close of 1861. Of the forms of citation used here and throughout the body of the work, it may be said that it is usually fairly clear just what is referred to, and this in spite of the fact that sometimes the forms used in zoölogical literature are adopted, sometimes other forms, presumably the author's, but almost never the form of citation adopted at the Madison meeting of the A. A. A. S., section G,

1893, which has received practically universal acceptance among American botanists. The bibliography, as a whole, however, will be invaluable to future students, in that it brings together, in one place, and for the first time, most of the important books and articles that have been printed, thereby making it possible to get bibliographic information on any given subject almost at a glance.

II. Geographic, Climatic and Floristic Survey. The first chapter of this part is a brief (pp. 93–130) geographical description of the continent and need not detain us, as it is necessarily a compilation from such authorities as Tarr, C. W. Hayes, J. W. Powell, Adams, Wright, R. T. Hill, Keane, and some of the publications of the Bureau of American Republics. The essay draws attention to all the more important physiographic features of our varied topography, and especially to those that have or have had a bearing on the distribution of American plants.

The selection of material for the second chapter on the climate of North America (pp. 130–165) presents some interesting sidelights on the author's point of view, and his conception of what are the chief climatic factors in the distribution of plants. After a rehearsal of the main climatic features and of some of the general principles of climatology, the book takes up the continental divisions in more detail. This is elaborated mostly from the reports of the United States Weather Bureau, and is as comprehensive, along certain lines, as the most critical could desire. The thing that strikes the curious note is the absolute failure to record any of the conclusions of Abbe on the relation between climate and crops, published in 1905, and which have revolutionized our ideas as to the effects of temperature on plant distribution. That maximum and minimum temperature, and that any method of reckoning accumulative temperature or heat units, are not the vital factors in this problem, has been discussed at length in numerous papers within the last three or four years. And the almost general consensus of opinion that the length of the growing season is the most important factor seems to have escaped the writer's notice. This is much to be regretted, as charts or tables for small areas, such as those in recent papers by Shreve, Gleason,

or the reviewer, showing the number of days between the last killing frost of spring and the first one of autumn, would have been, in the case of Dr. Harshberger's vastly greater range, of the utmost possible usefulness in the orientation of our ideas on plant "life-zones" of the North American continent north of the frost line. In connection with the discussion of rainfall, it would have added interest to make some mention of the relative evaporating power of the air over different soils, as this has a very marked bearing on the ultimate amount of water available to the vegetation.

The West Indies and Central America present some difficulties when generalizations are attempted as to their climate. The one important factor, so far as a plant geographer is concerned, is the prevailing northeast trade-wind, as this has a greater effect on the plant distribution than almost any other single agency. Under this section, Dr. Harshberger makes only incidental mention of this wind, but later (pp. 672–704) he ascribes to it a more important position. The times and seasons of the rains in the larger West Indies are controlled by this moisture-laden wind, rolling in from the Atlantic and precipitating its water on windward slopes, leaving the drier southwesterly areas, on most of the islands, all but deserts. Of all this, nothing, in the account of West Indian climatology. Furthermore, in the Journal of the New York Botanical Garden for January, 1910, some little account of the temperature and rainfall of Santo Domingo was published, based on carefully kept records for two or more years, but no mention is made of this. Another feature of West Indian climatology that may excite some question, as presented by the writer, is the statement that the typical hurricanes originate in the open Atlantic. Many meteorologists have considered that these destructive storms originate in the Caribbean, just west of the coast of South America, in a gigantic heat vortex, cyclonically filled up by a sudden in-rushing of cooler air.

The third and shortest chapter (4 pages) of this part contains synopses of the most important tabulations as to the number of native and introduced species in North America, brought down as mentioned above, only to 1908.

III. Geologic Evolution, Theoretic Considerations and Statistics on the Distribution of North American Plants. If the historical factors, climatic, geological, and ethnological, have been the most important in the fixing of the permanent complexion of our vegetation, then this part of the book will doubtless be considered as of chief interest, for it deals with the most fascinating part of the origin and development of the North American flora. To the botanist, or even to the intelligent general reader, Dr. Harshberger has presented, almost dramatically, a picture of the beginnings of things floral on this continent, that will perhaps evoke criticism, but must meet with general admiration. The alternate rising and falling of the earth's crust, the encroachment of inland oceans over what is now dry land, the upheavals of our great mountain chains, the advance and recession of the continental glaciers, and many other minor geological phenomena, have had profound and fundamental influences on the migration of whole floras, the creation of interesting endemisms, and the struggle between heat- and cold-resisting floras.

The Cretaceous and Tertiary floras are first discussed (pp. 120–182), and a general review of the fossil-bearing strata, together with a list of the better known preglacial plants, is given. This list, to the botanist, will convey a very fair idea of the state of North American vegetation just before the beginning of the southward extension of the great continental glacier; and it serves also to fix in one's mind the vast climatic significance of the encroaching ice-sheet. That such genera as *Anona*, *Araucaria*, *Artocarpus*, *Bombax*, *Casuarina*, *Dalbergia*, *Eugenia*, *Inga*, *Grewia*, *Sabal*, and *Sterculia* should ever have flourished in what is now temperate America is evidence of the far-reaching change wrought by the ice.

The second chapter (pp. 182–203) deals with the development of the flora during the glacial periods, and calls attention to the facts of the alternate encroachment and recession of the glaciers and of the consequent see-sawing of heat- and cold-resistant types of plant life. The treatment of the endemisms created by the final recession of the glacier and of the formation of

glacial bogs, is well written and the author gives frequent acknowledgment to the excellent work of Transeau on this interesting problem.

In the third and longest chapter (pp. 203–311) of this part, the post-glacial and recent history of the North American flora is traced with some detail. That this part of the work, dealing with the forces that finally shaped our present condition of things floristic, should contain even a few errors or omissions is unfortunate. Attention should especially be called to the fact that south of the terminal moraine on Long Island the region is mostly Tertiary, and even more modern in formation, and not Cretaceous.*

In the consideration of the strand flora of New Jersey, which Dr. Harshberger has studied in some detail, he makes the statement that *Hibiscus moscheutos* followed the shore line of the old Penausken Sound, and that this circumstance explains the occurrence of this maritime plant in the middle of New Jersey. The explanation is ingenious enough, but it does not easily overcome the fact that near Spotswood, N. J., which is almost directly in the middle of the bed of Penausken Sound, the plant is thoroughly established.†

Lack of space forbids mention of many things discussed in this part of the work, although they are of surpassing interest to the phytogeographer and ecologist. It is enough to say that the writer takes up each section of the continent, and gives what he considers to have been the final adjustments of the flora to its environment, and tells us what, to him, have been the underlying factors in the development of the ultimate floristic characteristics of the country.

Such minor inaccuracies as the statement (pp. 276 and 621) that *Crossosoma* is confined, for the most part, to the Californian islands, when really there are at least two other species on the

* This error occurs throughout the work. See pp. 218 and 421. According to geological survey maps, the only outcroppings of Cretaceous on Long Island are a few small ones on the north shore, near the western end of the island.

† Dr. Harshberger makes no mention of the interesting and suggestive observations of Harper on the relation between the flora of the glaciated and unglaciated region along the Atlantic coast.

continent, and that *Artemesia tridentata* is of the "senecoid composites" (p. 188), instead of being in the tribe Anthemideae, do not necessarily detract from the usefulness of the work, for these are questions of taxonomy, and not details that one must expect every phytogeographer to record with unerring accuracy.

After describing, in chapter four (pp. 311–341), the affinities of the North American flora, comparing each of the sections with neighboring regions,* or those further removed that have contributed floral elements, the author takes up, in the fifth chapter, the classification of North American phytogeographic regions. Citing among others, those previously published by Grisebach, Engler, Drude, Merriam (whose classification, by the way, was as much zoölogical as botanical), and Clements, with the statement that Engler's classification of 1902, seems to the author "the most complete and satisfactory," Dr. Harshberger writes thus: "The classification presented herewith (his own) represents, the writer believes, the present status of our knowledge concerning the geographic distribution of American plants. In it is incorporated all that is good in the classifications that have preceded, without sacrificing originality."

IV. North American Phytogeographic Regions, Formations, Associations. The fourth and much the longest part of this work is taken up with a particular description of the vegetation as it is to-day and as it impresses the author. There are many who will cherish the thought that this enormous amount of labor (pp. 347–704) might well have been left to form the nucleus of another book. And this, not only because the minute description of plant formations and associations is as much ecological as phytogeographic, but also because of the vast amount of more or less stereotypic repetition that must ensue in the description of closely related areas which differ only in minor details; a repetition almost wearisome, in a book of this character, but interesting enough in a sketch of more or less limited areas, or a small series of them. The account of the vegetation of the Arctic tundra and of the peculiar formations of Alaska, Labrador,

* The citing of *Phyllospadix* of the Zosteraceae, on page 313, as an example of endemism, under arctic algae, is an unhappy slip of the pen.

and Hudson Bay regions is valuable; but he must be an ardent believer who can, with complete mental composure, read a description of the lake, swamp, bog, coniferous forest, and deciduous forest formations each seven or more times, the salt marsh, alpine, barren, strand, and dune formations each five times all in the second and third chapters (pp. 360–516), dealing with the vegetation east of the Mississippi and some of its tributaries. Add to this dozens of minor formations, scores of associations, areas, circum-areas, etc., and the indigestibility of the whole mass may be imagined. Granting, however, the suitability of this vast bulk of minutiae in a work on North American phytogeography, the problem has been handled with as much skill, at least as to form, as the almost hopeless nature of the task would permit.

Some statements challenge attention in this part, as, for instance, the assertion (p. 372) that *Drosera rotundifolia*, *Prunus pennsylvanica*, and *Fragaria virginiana* are true alpine plants, that *Opuntia Rafinesquii* is found on Nantucket (p. 380), that *Clintonia borealis* is a bog plant (p. 385), that *Potamogeton Vaseyi* and *Spirillus* are truly Laurentian* in distribution (p. 392), that *Sassafras* is typically pine-barren (p. 415), and, most important of all, the statement (p. 481) that in West Virginia there is a series of ponds and lakes which represent water-filled kettle-holes of glacial origin!

The third and fourth chapters of this part continue, with a nearly similar completeness, the description of the vegetation stretching to the Pacific Coast, including the Californian islands. Chapter five considers the Mexican subtropic zone and mountain region, and chapter six, the tropical Mexican and Central American regions. The last four chapters (pp. 516–672) are necessarily briefer than those dealing with better known regions, but they give a valuable account of their respective areas as we know them to-day. While it is true that our knowledge of the West Indian region is still somewhat limited, we should have expected Dr. Harshberger to have availed himself more fully

* Both are found within the Laurentian area, but neither is typical of this area, as they are both found far south of it. The citation of *Potamogeton* distribution as indicative of or resulting from any particular formation, is open to question, as most aquatics may be found far from what is their conjectural center of distribution, and for obvious reasons.

in chapter seven (pp. 672–704) of the results of the extensive explorations, in nearly every West Indian island, by various members of the staff of the New York Botanical Garden.

So much for a very meager record of the most important phytogeographical work that has appeared in this country. If the review seems to be little more than a catalog of errors and omissions, it must be stated that only the more important errors of fact have claimed attention, and that scores of minor inaccuracies have been glossed over owing to lack of space.

In the recently issued first part of a history of botany by E. L. Greene, we have become familiar with a style of writing that has set a high literary ideal for all future botanical works in this country. The warmest admirer of the present book can never, unfortunately, claim for it consideration as a piece of literature. Note for example the following quotation, exactly copied as to punctuation and wording. "For facility in treatment and also for the purpose of classification the following broad arrangement will be followed in presenting the historic facts which concern this chapter with the following broad classification of material according to geography:" . . . . (p. 1). Besides the two pages of corrections published in the beginning of the work, the reviewer has found at least as many more typographical errors that escaped the reader of the proofs. It is perhaps almost impossible to guard against such things in a book written here and printed and edited in Germany.

The eighteen plates are notable contributions to the illustration of North American plants and their habitats, but of the thirty-two text figures, thirteen are from *Die Natürlichen Pflanzenfamilien* or *Das Pflanzenreich*, and lack altogether phytogeographical or ecological significance. The rest are from photographs and much more valuable.

A very complete index of plants (pp. 704–790 is most useful, but a similarly complete index of localities, formations, associations, etc., and of persons would have been of the greatest utility.

In conclusion, the book may be said to be of far-reaching usefulness in that it attempts what no other work has heretofore attempted. That it will fill a long felt want is a foregone conclusion.

NORMAN TAYLOR

NOTES AND NEWS ITEMS

The *Experiment Station Record* for June has this to say editorially of recent work with the respiration calorimeter. "Of late a new line of experiments has been undertaken with the respiration calorimeter, which marks a departure in studies of this kind and indicates a broader application of the apparatus. These new studies relate to the ripening of fruit, and are being carried on in coöperation with the Bureau of Chemistry. They have shown that the apparatus is suited to studies of the changes going on during ripening, and that as a living body the functions of the plant as well as of animals may be observed."

"A number of bunches of green bananas were placed in the respiration chamber and kept under observation until the ripening process was completed to the usual commercial stage, which requires three or four days. During this time the oxygen consumption, the carbon dioxid excretion, and the heat elimination were determined in a manner not previously possible, throwing interesting light on the chemical process of ripening."

"These experiments have been repeated sufficiently to check the results and suggest the nature of the changes. Important data have already been obtained regarding the respiratory quotient, the carbon dioxid thermal equivalent, and the amount of energy liberated by the bananas during the ripening process. The indications are that physical and chemical factors which are of the greatest value in the study of this problem, important from a practical as well as a theoretical standpoint, can be accurately measured with the respiration calorimeter. The results will assist in the interpretation of analytical studies and throw a new light on the problems involved in the ripening and storage of fruit. As the method is applicable, not only to fruit of all kinds, but to vegetables and other products, it is believed to have a wide range of possibilities."

"It has been suggested furthermore that some of the changes taking place during the germination of seeds, a subject which has been studied in other ways, could be more accurately determined. The heating of grain in storage is also a problem to the study of

which the apparatus lends itself. With certain adaptations, which are believed mechanically possible, the apparatus might be used in connection with growing plants to study their transpiration, respiration, etc., as well as the energy required for these different physiological processes. But little is known regarding the energy changes of plant activity, and this apparatus seems to afford means of extending knowledge along that line. Indeed, the possibilities for the study of the respiratory exchange and energy production of vegetable products and plant life are well-nigh unlimited, and open up a line of investigation of great importance."

The seeds and plants imported by the Bureau of Plant Industry in the early part of 1910 make, with their descriptions, an eighty-page booklet which is supplied free of charge by the Department of Agriculture.

Volume one, number one, of the Journal of the Washington Academy of Sciences has just appeared. It is " . . . a medium for the publication of original papers and a record of scientific work in Washington [D. C.]. It accepts for publication (1) brief papers written or communicated by resident or non-resident members of the academy; (2) abstracts of current scientific literature published in or emanating from Washington; (3) proceedings and programs of the affiliated societies; and (4) notes of events connected with the scientific life of Washington." The journal is a semi-monthly, costs six dollars a year to non-members of the academy, and is not offered in exchange. Very little botanical is found in this first number, but there are abstracts of W. H. Kempfer's paper on the preservative treatment of poles, and of F. G. Plummer's Forest Service Bulletin No. 85 on "Chaparral: Studies in the dwarf forests, or elfin wood of Southern California."

Bulletin 87 of the Forest Service deals with the Eucalpyts in Florida. It contains nearly fifty pages of interesting reading, illustrations, and a table showing the various species, their uses, rate of growth, climatic and soil requirements, etc.

Some time ago the Alabama Polytechnic Institute issued a circular on school improvement. The joint authors, R. S. Machintosh and P. F. Williams, have given good general advice for the successful work and maps showing various treatments of plots of various sizes. The short descriptive list of trees, shrubs, vines, and herbs adds much to the value of the pamphlet and suggests that such a boooklet would be useful for every state and prevent the mistakes often made—not only in the planning of the grounds but in the yearly Arbor Day work. Too often schools have little or nothing to show for the energy spent in such exercises, or else a quantitative success with a tiresome sameness.

Investigating the assimilation of atmospheric nitrogen by fungi, L. H. Pennington (BULLETIN Torrey Botanical Club, March) worked with several common molds and secured results "in harmony with the generally accepted notion that fungi do not have the ability to assimilate atmospheric nitrogen." The definite reports to the contrary may be explained by experimental error; or probably by variation in the different strains of fungi. With this last explanation in view distinct strains are being isolated to test variations in this ability.

Protective enzymes have been studied in pomaceous and other fruits by several workers from the Delaware Agricultural Station (*Science*, April 10). The work was suggested by experiments on the toxicity of tannin, and the conclusions follow: (1) Normal living fruits contain two enzymes, a catylase and an oxidase. (2) Tannin, as such does not exist in any part of the normal uninjured fruit previous to maturity, except possibly a small amount in the peel. (3) The oxidase acts only in an acid solution; it helps form a tannin or tannin-like substance which can precipitate proteid matter and form a germicidal fluid. (4) These changes may be caused by injuries to normal immature fruits by fungi, insects and mechanical agencies.

Under "A Universal Law" Wilder D. Bancroft calls attention in the Journal of the American Chemical Society to the universal law known to biologists as the survival of the fittest and to

physicists, chemists, business men, etc., by various other names. A wide range of illustrations is given, taken almost entirely from the biological sciences and grouped under such topics as pressure and concentration, temperature, light, moisture, food and fertilizers, secretions, climate, and non-adaptability. The biologist's point of view is discussed, and spontaneous variation is described as "merely another way of expressing our ignorance" due to the fact the present and transmitted effects of external conditions are known but incompletely. The article was reprinted in *Science* and has been the cause of much commendatory discussion.

Professor Bessey has corrected the plant group estimates given in *Torreya*, adding (approximately) 1,300 to the ferns, 70 to the gymnosperms, 3,700 to the monocotyledons, and 18,000 to the dicotyledons. These, with a few other changes, make a total estimate of 233,000 instead of 210,000.

Frederick V. Coville (*Science*, May 5) suggests growing trailing arbutus in acid soils. Successful experiments were conducted with these plants—so rarely seen in cultivation—by using an acid soil, nine parts kalmia peat and one part clean sand. By March seeds from the previous July had produced plants unusual in size (seven-eighths of an inch in diameter) and fragrance. Mr. Coville incidentally describes the fruit of the arbutus as juicy instead of dry and states that the dehiscence is not loculicidal. At the lecture on June 3, at the New York Botanical Garden, Mr. Coville showed many interesting lantern photographs, and demonstrated more extensively on the cultivation of numerous plants of the heath family and of some of our local orchids in acid soils.

The following single sheet publication of the Department of Agriculture is attracting wide notice: "A New Kind of Corn from China." "A small lot of shelled corn, of a kind that is new to this country, was sent to the U. S. Department of Agriculture from Shanghai, China, in 1908, and tested the same season. It proved to have qualities that may make it valuable

in breeding a corn adapted to the hot and dry conditions of the Southwest. The plants raised in the test averaged less than 6 feet in height, with an average of 12 green leaves at the time of tasseling. The ears averaged $5\frac{1}{2}$ inches in length and $4\frac{1}{3}$ inches in greatest circumference, with 16 to 18 rows of small grains. On the upper part of the plant the leaves are all on one side of the stalk, instead of being arranged in two rows on opposite sides. Besides this, the upper leaves stand erect, instead of drooping, and the tips of the leaves are therefore above the top of the tassel. The silks of the ear are produced at the point where the leaf blade is joined to the leaf sheath, and they appear before there is any sign of an ear except a slight swelling.

"This corn is very different from any that is now produced in America. Its peculiar value is that the erect arrangement of the leaves on one side of the stalk and the appearance of the silks in the angle where the leaf blade joins the sheath offer a protected place in which pollen can settle and fertilize the silks before the latter are ever exposed to the air. This is an excellent arrangement for preventing the drying out of the silks before pollination. While this corn may be of little value itself, it is likely that, by cross-breeding, these desirable qualities can be imparted to a larger corn, which will thus be better adapted to the Southwest.

"The discovery of this peculiar corn in China suggests anew the idea that, although America is the original home of corn, yet it may by some means have been taken to the Eastern Hemisphere long before the discovery of America by Columbus. From descriptions in Chinese literature corn is known to have been established in China within less than a century after the voyage of Columbus. But this seems a short time for any plant to have become widely known and used. Besides, this particular corn is so different from anything in the New World that it must have been developed in the Old World, and for that to happen in a natural way would take a very long time. These ideas are brought out in Bulletin 161 of the Bureau of Plant Industry, which gives also an account of some cross-breeding experiments with the new corn and the changes which crossing produces in the grains the same season."

TORREYA

October, 1911

Vol. 11 No. 10

A BOG IN CENTRAL ILLINOIS*

By Frank C. Gates

At the headwaters of Lake Matanzas, a bayou of the Illinois River in Mason County, Illinois, about forty miles south of Peoria, is situated a bog which the writer visited during July, 1910. The bog is of interest because it is so far south of the usual southern limits of peat-bog plants, as outlined by Transeau.† In it occurs a curious mixture of swamp, bog, and mesophytic plants. The many attempts to separate swamps and bogs by purely physical factors have always virtually proved futile. The plants themselves are the indices and there need be no difference in the environmental factors.

The bog proper is an area, 0.04 of a square mile in extent, in which the soil is a water-soaked muck, imperfectly drained towards Lake Matanzas. The drainage lines are indicated during the summer by small creeks, without open water but hidden by very dense growths of *Leersia oryzoides*. Occasionally a few plants of *Cinna arundinacea* accompany the *Leersia*. This association ends abruptly at the edge of the running water. (Fig. 1.)

The historical factor has the greatest weight in accounting for this bog, for it is known that in times past central Illinois was vegetated by northern plants. Following the retreat of the glaciers this northern vegetation has been displaced by

* Contributions from the Botanical Laboratory of the University of Michigan No. 128. Submitted with the spelling in accordance with the recommendations of the Simplified Spelling Board, and changed to conform to the editorial policy of Torreya—N. T.

† Transeau, E. N. "On the Geographic Distribution and Ecological Relations of the Bog Plant Societies of North America." Bot. Gaz. **36**: 401–420. 1903 (with a map).

[No. 9, Vol. 11, of Torreya, comprising pp. 181–204, was issued 12 Sept. 1911.]

prairie and deciduous forest types of vegetation. There still remain, however, isolated spots, under peculiar local conditions, in which the northern plants persist as relics. At Lake Matanzas the bog is located in soggy ground, fed by cold-springs at the base of the bluff, bordering the lake on the eastward. Only a part of the area is occupied by bog plants, at the present time, and the evidence goes to show that swamp plants are gradually displacing them.

FIG. 1. A portion of the Matanzas Bog, showing a stream course marked by *Leersia oryzoides*, bounded by *Saururus*, back of which are shrubs (*Cephalanthus*) and trees (*Betula nigra*). July 24, 1910.

The ground at the foot of the bluff, kept relatively cold by the water from the springs, is occupied by a luxuriant growth of *Berula erecta*, a northern bog plant. The compound leaves of the first-year plants form a dense mat over a strip about two meters wide from which the flowering stalks of the second year arise. Usually this growth occupies the entire space but not infrequently, especially on the side away from the springs, there

were other low herbaceous plants of which the most abundant were *Mimulus glabratus jamesii*, *Galium trifidum*, *Poa* sp., *Eupatorium perfoliatum* and *Aspidium thelypteris*. Less important species were *Pilea pumila*, *Impatiens biflora*, *Bidens vulgata*, *Scutellaria lateriflora*, *Carex lurida*, *Bidens comosa*, *Veronica scutellata*, *Saururus cernuus*, *Eupatorium* sp., *Oxypolis rigidus*, *Peltandra virginica*, *Rumex Britannica*, *Iris versicolor*, *Sagittaria

FIG. 2. A portion of the cold-spring area showing *Berula erecta* with *Mimulus glabratus jamesii* and the inroad of swamp plants on the side away from the springs. July 24, 1910.

brevirostra*, *Agrostis alba*, *Cicuta bulbifera*, *Boehmeria cylindrica*, *Ranunculus pennsylvanicus*, *Steironema ciliatum* and *Cinna arundinacea*. (Fig. 2.)

In a few places in the *Berula* area there are invading thicket plants which indicate the trend of succession. The thickets are usually formed by *Salix* with *Sambucus* but three were formed by very dense recurving growths of *Decodon verticillatus* about 1.9

meters high. In the center of one of these thickets were plants of *Mentha arvensis canadensis* and *Chelone glabra*, over two meters high, whose exceptionally slender stems were supported by the surrounding *Decodon*.

Bordering the *Berula* association on the side away from the springs and along the creeks just beyond the running water, the *Saururus* association has developed. This association is composed of exceptionally well-developed plants of *Saururus cernuus*, growing somewhat more than a meter high, with large leaves, many long flowering spikes and numerous seeds. With the *Saururus* were virtually no other plants. (Fig. 1.)

Bordering the narrow strip of *Saururus* was a somewhat wider strip of thicket plants, most important of which were *Salix longifolia*, *Cephalanthus occidentalis*, *Cornus amomum* and *Rosa carolina*. In any given spot one of these usually grows to the exclusion of the others, but all of them occupy the same relative position in the vegetation. *Cephalanthus* and *Cornus* occur more abundantly on the springy boggy soil nearer the headwaters of the little creeks, while the *Salix* is very much more abundant nearer Lake Matanzas and along the nearby Illinois river. Thicket plants occur over nearly the entire area but they produce their characteristic appearance only near the creeks, for elsewhere trees are rapidly assuming dominance. Usually the ground is bare of plants and consists of muck together with the debris which the lower sprawling stems of the bushes have sifted from the flood waters of the Illinois river. A sparse growth of herbaceous plants may be present in openings which admit sufficient light to reach the ground. Most important of such species are *Asclepias incarnata*, *Boehmeria cylindrica*, *Peltandra virginica*, *Apios tuberosa*, *Cicuta maculata*, *Iris versicolor*, *Steironema ciliatum*, *Ranunculus abortivus*, *Pilea pumila*, *Eupatorium perfoliatum*, *Lippia lanceolata*, *Verbena hastata*, and in addition, seedlings of *Betula nigra*, *Acer saccharinum*, *Fraxinus nigra* and *Fraxinus americana* may also be present.

The greater part of the bog is covered by the bottomland woods. Although the usual bottomland trees are present, the association does not appear normal as it has not yet become

entirely adjusted to the increase of water level following the establishment of the Chicago Drainage Canal.

The *Platanus occidentalis* association is represented fairly well in the bog area by a number of seedlings in the thickets and along the little creeks, and by a few young trees between the *Cephalanthus* and the *Ulmus-Acer* association. *Platanus* persists quite readily as a relic after the *Ulmus-Acer* association obtains dominance. Both the *Platanus* and the *Ulmus-Acer* associations occupy the drier portions of the bog area and there they readily obtain dominance over the thickets.

The *Ulmus-Acer* association is represented by several of the species of trees which characterize it. The proncipal ones involved are *Acer saccharinum*, with many, well-developed, medium-sized trees, 2–3 dm. in diameter, furnishing an abundance of seedlings; *Ulmus americana; Ulmus racemosa*, with a few small trees, 1.0–1.5 dm. in diameter and several young trees; *Fraxinus nigra*, with a few fair-sized trees and several small ones; *Fraxinus americana*, with several fair-sized and many small trees; *Betula nigra*, with a few medium-sized and several small trees; *Quercus platanoides*, with a few small trees; *Tilia americana*, with a few small trees and one large one; and *Platanus occidentalis*, with a few large relics. Of these the *Acer*, *Betula*, *Ulmus* and *Tilia* incline towards the higher and consequently drier ground, often forming oases in the bog. In such places the shade is very dense and the undergrowth is entirely absent. There is usually considerable undergrowth elsewhere, although but little of it is characteristic of the *Ulmus-Acer* association. This undergrowth is a curious mélange of several species from different associations and formations. In point of numbers the thicket elements are probably best represented with numerous plants of *Cornus amomum*, *Rosa carolina*, *Cephalanthus occidentalis*, *Salix discolor* and *Salix longifolia*. Several young trees are present, notably *Juglans nigra*, *Gleditsia triacanthos*, *Celtis occidentalis*, *Diospyros virginiana* and *Betula nigra*, all of which are characteristic trees in the mesophytic forests of central Illinois. The herbaceous flora includes such a typically northern bog plant as *Spathyema foetida* mixed in with typical swamp plants, as *Asclepias incarnata*, *Spar-*

ganium eurycarpum, *Amsonia tabernaemontana*, and *Impatiens fulva*, meadow and thicket plants as *Onoclea sensibilis* and *Steironema ciliatum* and mesophytic woodland plants as *Tecoma radicans*, *Laportea canadensis* and *Ranunculus abortivus*. Some of these plants, as *Spathyema*, occur here near their southern limits, while others, as *Amsonia* and *Tecoma*, are at their northern limits.

FIG. 3. A general view of the Matanzas Bog from the bluff, showing the succession from the *Berula* in the foreground, through the shrubs to the trees. July 24, 1910.

Doubtless many other interesting points could be brought out during the spring and fall but the region was investigated only in midsummer.

The presence of *Spathyema* and *Berula* is especially interesting because it is an occurrence of northern plants far south of their normal southern limits of their characteristic associations. They serve as indices to show the character of the former vegetation of central Illinois. That one should find these northern plants

mixed in with southern ones near their northern limits is significant as it demonstrates that vegetation representing different provinces can exist under the same environmental factors.

UNIVERSITY OF MICHIGAN

TWO SUBMERGED SPECIES OF UROMYCES

BY FRANK D. KERN

About twenty-five years ago Professor F. L. Scribner, of the U. S. Department of Agriculture, sent samples of several grasses infested with forms of Ustilaginales and Uredinales to Messrs. Ellis and Everhart for study. Among these was a rust on the leaves of *Aristida* from New Mexico which they were unable to refer to any published species and which they therefore described as a new species, *Uromyces Aristidae* Ellis & Ev.* There is throughout the United States east of the Rocky mountains a rather well-known *Uromyces* on species of *Aristida* which has, since the publication of the name by Ellis and Everhart, naturally passed as *U. Aristidae.*

Recently the writer had opportunity to examine the type specimen of *Uromyces Aristidae* Ellis & Ev. which is in the Ellis collection at the New York Botanical Garden and was much surprised to find that it is not at all like the ordinary form which has received that name in most mycological collections. Only uredinia can be found on the type specimen but they are so essentially different from the uredinia of the common *Uromyces*, especially in the presence of paraphyses and in the surface markings of the urediniospores, that there can be no possibility of their belonging to the same species. Since there are no telia on the type specimen it is not even certain that it is a *Uromyces;* it might as well be a *Puccinia* so far as any character present would indicate. Ellis and Everhart doubtless mistook the urediniospores for the teliospores of a *Uromyces*, an error not infrequently made by the earlier mycologists.

Strangely enough among all the specimens of rust on *Aristida* not a one, belonging either to *Uromyces* or *Puccinia*, has been

* Jour. Myc. 3: 56. 1887.

found which has uredinia agreeing with the type specimen of *Uromyces Aristidae* Ellis & Ev. There is an unnamed *Puccinia* from central Mexico which is like it in possessing paraphyses but which has the characters both of the paraphyses and urediniospores so different that there is scarcely a possibility of their identity. It is, therefore, impossible to dispose of the *Uromyces Aristidae* Ellis & Ev., of which there is known but the one specimen consisting of uredinia only, in any definite way without additional material and further study. It is certain, however, that the name *U. Aristidae* Ellis & Ev. can no longer, in the face of the foregoing facts, be applied to the real *Uromyces* on *Aristida*. Through the work of Arthur* this *Uromyces*-form has been culturally connected with an *Aecidium* on various species of *Plantago*. According to the practice followed by some mycologists the specific name of the aecial stage may become the name of the species provided the telial form has never received a name. In this instance, however, no such procedure is possible there being no available aecial name. The American aecia on *Plantago* have passed under the name *Aecidium Plantaginis* Ces. but they are distinct from that form. It is, therefore, necessary to supply a name for the *Aristida-Plantago* species which may be described as follows:

Uromyces seditiosus sp. nov.—O. Pycnia amphigenous, gregarious, inconspicuous, honey-yellow becoming brownish, subglobose, 80–100μ in diameter by 100–112μ high.

I. Aecia amphigenous, gregarious, cupulate or short-cylindric, 0.2–0.3 mm. in diameter; peridium colorless, margin erose, erect or somewhat recurved; peridial cells rhombic in longitudinal section, 28–35μ long, the outer wall thick, 10–13μ, transversely striate, the inner wall thinner, 4–5μ, verrucose; aeciospores subglobose or broadly ellipsoid, 14–18 $\times$ 16–22μ, the wall colorless, rather thin, 1.5μ, finely verrucose.

II. Uredinia epiphyllous, scattered, linear or oblong, cinnamon-brown, naked; urediniospores globoid, 19–26μ in diameter, the wall cinnamon-brown, moderately thick, 2–2.5μ, minutely verrucose, appearing almost smooth when wet; pores rather indistinct, 4, equatorial.

III. Telia epiphyllous, scattered or sometimes crowded and

* Bot. Gaz. 35: 17–18. 1903.

irregularly confluent, oblong, or linear 0.2–0.4 mm. wide by 0.5–1 mm. or more long, early naked, compact, pulvinate, dark chocolate-brown; teliospores broadly ellipsoid, or obovoid to nearly globoid, 15–21 × 23–39μ, rounded or obtuse at both ends, the wall chestnut-brown, usually with a slightly paler umbo, about 1.5–2μ thick, much thicker at apex, 5–10μ; pedicel tinted, rather stout, once to twice length of spore.

O and I on PLANTAGINACEAE: *Plantago aristata* Michx., Missouri (*Galloway*), Texas (*Long*); *P. eriopoda* Torrey, Montana (*Kelsey*), Wyoming (*Nelson*); *P. Purshii* R. & S., Nebraska (*Bates*), Texas (*Long*); *P. Rugelii* Dcne., Missouri (*Galloway*); *P. Tweedyi* A. Gray, Montana (*Jones*), Wyoming (*True*); *P. virginiana* L., Illinois (*Seymour*), Missouri (*Galloway*), South Carolina (*Ravenel*).

II and III on POACEAE: *Aristida basiramea* Engelm., Kansas (*Carleton*), Nebraska (*Bates*); *A. dichotoma* Michx., Arkansas (*Bartholomew*), Kansas (*Norton & Thompson*); *A. oligantha* Michx., Kansas (*Bartholomew*), Texas (*Long*); *A. purpurascens* Poir., Alabama (*Stone*), Kentucky (*Short*), New Jersey (*Ellis*).

Type collected at Wakeeney, Kansas, on *Aristida oligantha*, Sept. 15, 1906, *E. Bartholomew* (Barth. Fungi Columb. *2390*).

The uredinia of the *Uromyces Aristidae* Ellis & Ev. have paraphyses intermixed with urediniospores, the urediniospores are ellipsoid, 23–26 by 27–30μ, the wall is 2.5–3μ thick, finely and bluntly echinulate, and has 5–7 scattered pores.

Spartina is one of the most interesting genera of grasses from the mycologist's point of view on account of the unusually large number of species of rust which inhabit it. At least three species of *Puccinia* and two species of *Uromyces* have been described on it.* The validity of the three species of *Puccinia* is unquestionable but this can not be said of the *Uromyces*-forms. It is debatable whether *U. acuminatus* Arth. and *U. Spartinae* Farl. should be regarded as two species or whether they represent races of a single, somewhat variable, species. The results of cultures† might perhaps be interpreted as grounds for keeping the two forms separate but morphologically they intergrade in such a way as to throw doubt on that disposition. Without attempting

* For an account of the species inhabiting *Spartina* see Bot. Gaz. 34: 1–20. 1902.

† See Mycologia 2: 221–222, 229. 1909.

to settle that point the writer wishes now to call attention to a *Uromyces* which is undoubtedly distinct from either *U. acuminatus* or *U. Spartinae.* Its distinctive characters are the brownish or purplish spots which are produced about the sori and the few equatorial pores of the urediniospores. Neither *U. acuminatus* nor *U. Spartinae* produces such spots and both have numerous scattered pores. The new form comes from southern Florida and may be characterized thus:

Uromyces argutus sp. nov.—O and I. Pycnia and aecia unknown.

II. Uredinia amphigenous, scattered, on rather large brownish or purplish spots, linear, 1–4 mm. long, rather tardily naked, slightly pulverulent, cinnamon-brown; urediniospores broadly ellipsoid, 19–23 × 25–32μ, the wall rather thick, 2–3μ, light cinnamon-brown, finely echinulate; pores 3, occasionally 4, approximately equatorial.

III. Telia amphigenous, scattered, sometimes on discolored spots like the uredinia, linear, 1–2 mm. long, rather tardily naked, pulvinate, blackish; teliospores ellipsoid or obovoid, 16–19 × 24–32μ, usually narrowed both above and below, the wall dark chestnut-brown, 1.5–2μ thick, much thickened at apex, 7–10μ, smooth; pedicel tinted, about twice length of spore.

Type collected at Miami, Florida, on *Spartina glabra* Muhl., March 25, 1903, *E. W. D. Holway.*

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REVIEWS

Duggar's Plant Physiology*

Professor Duggar's "Plant Physiology" occupies a zone of tension between pure and applied science, and it is not easy to do the book entire justice in a review, owing in part to the fact that it is quite unlike anything else we have, and the reviewer has continually to adjust his orientation. It seems to the writer that the book would be less liable to misinterpretation if the title by which it was announced in advance, "The Physiology of Plant Production," had been retained on the title-page. As

* Duggar, Benjamin M. Plant Physiology, With special reference to plant production. Pp. i–xv + 1–516, frontispiece and figs. 1–144. New York. The Macmillan Co. 1911. Price $1.60.

a college text-book on plant physiology it would be quite inadequate, but as text on the physiology of plant (crop) production it is a distinct success. The point of view of the entire book may be inferred from the statement on page 495, where, in discussing growth movements, the author says: "A study of the phenomena is more important educationally in liberalizing our views of plant relations than of any direct assistance in special problems of plant production."

At various points throughout the text one queries as to whether or not the student is expected to have had a college course in elementary botany. If so, much of the pure physiology of the book will be of the nature of a review to him, except in so far as he follows out the admirable suggestions for collateral reading, given at the close of each chapter. If an elementary course is not taken for granted, then one may question the possibility of the reader understanding a discussion of proteoses and peptones, amides, Leguminosae, degradation products, amino and amido acids (p. 261), and "the curve of CO_2 excretion" (p. 287). In like manner the quotation on pages 309–310, from Coulter and Chamberlin, seems much too technical.

In discussing the relation of pruning to growth (p. 236), there is no reference to the very pertinent topic of the self-pruning of many trees; and the large amount of experimental work that has been done, in this country and in Europe, on the effects of the electric current in soil and air, on crop-production, and the very considerable literature that exists on the subject would seem to merit at least a passing reference in a book of this scope.

On page 69 turgor is attributed to hydrostatic pressure, though on page 67 osmotic pressure is correctly said to vary "with the number of particles in the solute." Growth is held to involve differentiation (pp. 307–308), thus taking no account of a fundamental distinction quite commonly held elsewhere, and especially necessary to recognize for many lower plants. In the first table on page 431 the meaning of the figures and of the column-headings is not obvious; the character μ, used in the table at the bottom of page 423, is nowhere explained in the book; and in the table on page 405 it is not clear what units of time are referred to.

The definition of adsorption, on page 440, restricts it to the reduction of toxicity by solid particles.

In Chapter XVI, on "The Temperature Relation," the importance of the length of the growing season (the period between the last killing frost of spring and the first one of autumn) is not emphasized. All temperatures are given in degrees Centigrade, and no reference is made to Professor Abbe's work of 1905.

The statement on page 468 that "great diversity of opinion prevails with regard to the magnitude [*sic*] of the variations by means of which progress in selection is maintained," tends, in the light of the preceding paragraph, to perpetuate the error that the difference between mutation and fluctuation is one of degree; and the assertion on page 469, that "Many deny permanence to this type of selection" (of fluctuating variations in sugar-beets) seems quite too mild, in view of recent work.

On page 474 it is stated that "the extreme supporters of the mutation principle . . . actually exclude the possibility of any such phenomenon as transmissible fluctuation," yet de Vries, himself, has said* that "The answer to the question whether acquired characters are inherited, is that they are not so in their entirety, but with a reduction, the amount of which is indicated by Galton's law"; and he later calls attention to the fact that if there were no inheritance of fluctuating variation, the improvement of horticultural races would not be possible.

The laboratory directions at the end of each chapter are well adjusted to the text, and especially so to the class of students for whom they are intended. One wonders, though, how many hours of credit should be allowed the poor "Agric." who is required (p. 378) to "make a careful count of the number of blossoms produced" by an apple tree! A number of investigators would be glad to learn how to determine "the moment of wilting" of a plant (p. 62); and a knowledge on the part of the student of the precautions necessary in order to weigh a number of slightly wilted leaves "accurately upon a delicate balance" (p. 63) can hardly be taken for granted. On pages 223 and 224

* De Vries, Hugo. The Mutation Theory. Eng. Translation. Vol. II, p. 136. 1911.

it is implied that starch-accumulation is synonymous with photosynthesis. A paragraph on page 433 is headed "Etiolation," but this term is not referred to or defined in the paragraph nor elsewhere in the book, nor does it occur in the index.

At numerous places the literary style and the English are such as to suggest that the text might have been dictated and not subsequently revised with sufficient care. Thus we find "this element" (p. 195), without any element being previously referred to in the paragraph; "The strong flavor of radishes . . . are also modified" (p. 426); "It is not always possible to distinguish positively between the two types, or the movement may be the result of conjoint stimulus" (p. 495).

However, the fact that is was so easy to single out the above points only means that the book is one of conspicuous merit. Since Johnson's "How Crops Grow" and "How Crops Feed," nothing of similar nature has appeared, and Professor Duggar has rendered distinct service in bringing forward in concrete form, with a carefully worked out solution, the whole question of a suitable presentation of plant physiology to agricultural students. Especially has the author made a very happy choice in the topics selected and excluded, and the book cannot help but conduce to clearer thinking, and a more intelligent practice on the part of the student and reader.

The text has distinct vitality because so much of it comes direct from the author at first hand, the illustrations are apt, and the book is sure to meet with the wide and warm welcome which it justly merits.

C. Stuart Gager

TAYLOR'S REVIEW OF THE PHYTOGEOGRAPHIC SURVEY OF NORTH AMERICA: A REPLY

The long and detailed review of my recent book in Torreya covering ten pages of the September, 1911, number of the journal is a surprising one, because the mark of a true critic is to give the other man the benefit of a doubt. Some of the points taken by Taylor in his review are justly made, but many of them are

not. With reference to the omissions to which he alludes, I would call his attention to the text and editor's footnote on pages 38 and 39, where the following will be found: "The above historic summary does not claim to be complete. The most salient facts have been chosen, which illustrate the development of knowledge of the several phytogeographic regions of North America. . . . The attempt has not been made to furnish a complete synopsis of the literature dealing with the phytogeography of North America." Then he should read the statement in the footnote by Professor Drude: "Auf besonderen Wunsch der Herausgeber hat Prof. Harshberger die ursprünglich ausführlicher gehaltene Liste der floristischen und pflanzengeographischen Literatur noch beschränkt, wie es auch in den anderen Bänden der V. d. E. gebräuchlich ist." Originally the book was limited to 480 pages, later the publishers agreed to print 640 pages, while the actual number which they undertook to print reached 790 pages and 63 pages of the synopsis in German by Professor Drude, and yet much had to be omitted to keep the book within a convenient size. It was, therefore, impossible to notice the more important recent books and papers, because many of them appeared while the book was in press. Frequently it happened that the author would see the book while the paged proof was in hand, and if a footnote could be added, as for example, the one on page 669 about Wercklé and Costa Rican vegetation, it was added, but frequently it was impossible without entirely rearranging the printed page to make such additions. The editors and publishers were unusually kind to me about such changes.

To see such a bulky book through the press required a long time and the criticism of the reviewer on this score will be found to be unfortunate when I give the most important dates connected with its publication. The letter requesting me to write the volume was dated Berlin, October 4, 1901. The typewritten manuscript was expressed to Dresden on September 12, 1906, and the first proof sheet beginning Part I was received by the author on September 26, 1908. The galley proofs were returned as follows: Chapter I, Part II, on November 6, 1908; Chapter I,

Part III, on December 23, 1908; Chapter I, Part IV, on September 28, 1909, and the last sheet of the text on May 25, 1910. The last galley proof of the index was mailed to Dresden on February 8, 1911. The corrections, title page, table of contents and preface were received after the entire book had been printed, and this statement refutes one of the points of criticism made by Taylor. I received the first bound copy of the volume on June 8, 1911.

Taylor mentions the fact that *Hibiscus moscheutos* occurs at Spotswood, N. J., in the middle of the bed of Pensauken Sound (notice the spelling in two places Penausken) is not well taken, for the plant which I supposed followed the shore line of the ancient sound might well have spread to the middle of the sound as the waters gradually retreated. The note on page 197 of his review is misleading, if the text is read again more carefully. I do not say on page 372 of the book that *Drosera rotundifolia*, *Prunus pennsylvanica*, *Fragaria virginiana* are true alpine plants, but give them in a list of the alpine plants of Mt. Katahdin.

I am glad that Taylor has given his opinion of my volume of Die Vegetation der Erde, and I hope what he has said will invite botanists to buy and read a volume which I trust will take its place as a sound contribution to North American phytogeography.

John W. Harshberger

University of Pennsylvania

[That I did not take into consideration the time necessary for such a large work to go through the press is perfectly correct. The dates given above by Professor Harshberger fix the time when the book left his hands, information most welcome,—as there is no indication of these important dates in either the preface or title-page of the work.]

N. T.

STEWART'S BOTANICAL SURVEY OF THE GALAPAGOS ISLANDS*

Mr. Stewart was the fortunate botanist appointed for this special expedition to the Galapagos Islands. He gives a brief history of the Flora of the Islands dating from Darwin and Hooker and follows with an account of the vascular plants annotated for the publications where the species were first published, and for the localities on the various islands of the group where the numbered specimens were collected. Following this annotated list he gives a series of tables showing the distribution of the vascular plants, these tables presenting columns assigned respectively to the different islands in which are marked the specimens, or records of occurrence by previous authors. The species are arranged in this list alphabetically, by genera, under each family, the families are presented in the general sequence of Engler & Prantl. Following the tables of distribution he presents a discussion of the botanical regions, distinguishing ecologically the dry from the transition and these in turn from the moist and grassy, etc., listing under each the commonest or most noticeable during the time of the Expedition.

Mr. Stewart then takes up in the order of families those interesting plants, or those genera or even whole families which present special points, as the number of species represented in proportion to other families characteristic of this region, or the citing of those which are conspicuous for the large and pure stands, or for their distribution over large areas and notes particularly that the Compositae are strongly represented in the moist regions, the chief representation of which are to be found in the extensive forests of *Scaesia*. Following, he presents a record of the weather conditions and the variety which these have presented at various times and the effects of the different periods of weather so far as indicated by the conditions of vegetation.

The Bibliography of three pages and a full Index by genera and families and a map of the Galapagos Islands with mountain

* Stewart, A. The Botanical Survey of the Galapagos Islands. Proc. Calif. Acad. Sci. IV. 1: 7–288. January 20, 1911.

elevations and ocean depths, and nineteen plates complete the volume.

This paper is characteristic of the usual good typography and uniform quality of paper of the publications of the California Academy of Sciences.

E. L. Morris

NOTES AND NEWS ITEMS

We learn from the *Review of Reviews* of the appointment of Professor F. P. Daniels as a travelling fellow on the Kahn Foundation. The itinerary of each fellow is expected to include Europe, Egypt, Japan, India and other Oriental countries and to take at least a year. Professor Daniels, now professor of romance languages in Wabash College, has done considerable botanical work in the middle west.

The death of Dr. Raymond Haines Pond is recorded as having occurred by his own hand, at College Station, Texas, on July 25. Dr. Pond received the degree of Ph.D. from the University of Michigan in 1902. From 1903 to 1907, he was professor of botany and pharmacognosy in the College of Pharmacy of Northwestern University; in 1908–'09 he held the position of biologist of the Metropolitan Sewerage Commission of New York City; and since 1909 he had been plant pathologist at the Texas Agricultural Experiment Station. A considerable part of the time between 1905 and 1908 was spent by him in carrying on researches in physiological botany at the New York Botanical Garden and at the universities of Bonn and Strassburg, and he had made several contributions to the literature of this department of botany. Dr. Pond was for a time a member of the Torrey Club.

In the recently issued annual report of the New York State Botanist is recorded the spread of the chestnut disease to Marlborough, Ulster Co., which, "with one exception is the most northern station for it in this State." The report summarizes the work of the past year, and includes among other things a list of about 80 plants new to the State herbarium, most of which are fungi. A brief account is also given of the changes going

on in the transformation of areas now water surfaced to land, particularly of the important part played in the process by swamps and bogs.

A History of Gardening in England, by Hon. Mrs. Evelyn Cecil (third and enlarged edition. Pp. 393. Illustrated. E. P. Dutton & Co., New York, 1910) which first appeared in 1896 is, as its title states, a history of gardening in England. The chronological bibliography itself, is, with its quaint titles, fascinatingly suggestive, and there is enjoyment and to spare, both for the long summer days and the winter fireside, in the four hundred pages describing monastic gardening and the gardens of the thirteenth to the sixteenth centuries, the early garden literature, the kitchen gardens, the dawn of landscape gardening, and the development of modern gardening.

The January *Science* contains two articles of interest to teachers of botany. The first on "The Method of Science" was delivered by Professor Charles S. Minot at the Minneapolis meeting (A. A. A. S., December), and is of interest to any science teacher, emphasizing as it does (1) the "concentration of interest upon novel practical results" not wholly favorable to science, (2) the need of encouraging the "pursuit of pure science" which "will not be compelled," and (3) that science differs from every day life in definiteness and the importance given therefore to the preservation of evidence. The steps in valid scientific work are "*first*, the record of the individual personal knowledge; *second*, the conversion of the personal knowledge by verification and collation into valid impersonal knowledge; *third*, the systematic coördination and condensation of the conclusions," and an interesting amplification of these points follows.

The Clarendon Press has just issued a small volume (*Vocabulaire Forstier*. Francais-Allemand-Anglais by J. Gerschel, Oxford, 1911. Price $1.75) which well covers its field of activity. About fifty pages are devoted to definitions of French forestry words, seventy-eight to German words, and sixty-two to English words. This difference in the number of words used by the three peoples furnishes a significant suggestion as to the relative importance among them of forestry.

The recently issued prospectus of the Brooklyn Institute of Arts and Sciences for 1911–12 includes, under the department of botany, 16 illustrated lectures, 4 illustrated conferences, 17 field meetings, and also outlines five courses covering various phases of botanical activity.

The following botanists have been working at the Marine Biological Laboratory at Woods Hole during the whole or part of the past season: C. M. Derick, B. M. Duggar, L. Knudson, G. R. Lyman, G. T. Moore, W. J. V. Osterhout, and M. B. Thomas.

At the University of Utah, C. N. Jensen has been appointed professor of botany and plant pathology for 1911–1912.

We learn from the daily press of the appointment of Dr. H. H. York as assistant professor of botany at Brown University, and of Dr. Anna Starr's appointment as instructor in botany at Mount Holyoke College.

On four successive Fridays, beginning October 13, Wilhelm Ludwig Johannsen, professor of plant physiology in the University of Copenhagen, will lecture on the "Modern Principles of Heredity," in No. 305 Schermerhorn Hall, Columbia University, at 4:10 P. M. The subjects will be "The Problem of Personal Characters," "The Problem of Unit Factors," "Problems of Correlation and Sex," and "The Problems of New Biotypes." The lectures are open to the public, but the doors will be closed five minutes after the beginning of each discussion.

According to the New York *Evening Post* (October 7) the regents of the University of Wisconsin have appointed E. M. Gilbert assistant professor of botany, and W. N. Steil, E. T. Bartholemew, and Alban Stewart instructors, to fill the positions occupied by W. G. Marquette and A. B. Stout, who have come to Columbia University with Professor R. A. Harper, the recently appointed Torrey professor of botany at that institution.

From the same source we learn of the appointment of Miss Helene M. Boas as an assistant in botany at Barnard College.

Professor H. C. Cowles of the University of Chicago was one

of a number of American scientists who attended the meeting of the British Association at Portsmouth.

Dr. and Mrs. N. L. Britton have returned from Europe and Dr. P. A. Rydberg has returned from a three months' collecting trip to the Rocky Mountains. Dr. Arthur Hollick left on October 15 to continue his studies on Alaskan fossil plants at the United States National Museum.

A conjugating yeast (*Schizosaccharomyces*) has been reported by W. C. Coker. It was obtained from grapes left in distilled water, and has not been noted before in America.

J. G. Lipman of Rutgers College proposes a bacteriological test for soil acidity. Tubes of bouillon are adjusted to varying acid reactions—from neutral to three per cent. After adding measured amounts of the soil to be tested (1 to 10 grams) these media are inoculated with bacteria (*e. g.*, *Bacillus subtilis*) and the amount of acid in the soils estimated by the resulting growth (heavy, slight, lacking). This method may be varied for ammonifying bacteria, for nitrogen-fixing forms, etc. Mr. Lipman expects to publish more definite results of his experiments soon.

The seedling of *Quercus virginiana* is described in the *Plant World* for May by Isaac M. Lewis. The "petiole of the cotyledons in this species serves as a 'sinker' in much the same way as is characteristic of certain monocotyledonous plants, notably *Phoenix dactylifera*. This habit, correlated with the habit of transporting the material from the acorn down to a position of greater safety in the fleshy root, would seem to be a decided advantage to the plant in establishing itself in the semi-arid situations in which it is often found."

Conjugation between two different species of *Spirogyra* (*S. crassa* and *S. communis*) is reported in the June *Bulletin of the Torrey Botanical Club* by Mr. F. M. Andrews, who is continuing his investigations hoping for interesting results connected with these hybrid forms.

TORREYA

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Vol. 11 No. 11

THE RIVER-BANK VEGETATION OF THE LOWER APALACHICOLA, AND A NEW PRINCIPLE ILLUSTRATED THEREBY

By Roland M. Harper

Every river is unique in some respects, and the Apalachicola, which is formed by the union of the Flint and Chattahoochee at the southwestern corner of Georgia, and flows in a general southerly direction to the Gulf, dividing West Florida from Middle Florida, seems to be more so than many others of similar size. Only one other river, the Alabama, carries water from the Piedmont region to the Gulf of Mexico, and the Apalachicola differs from that in several ways. In the first place, it has no connection with the Paleozoic region or the Cretaceous "prairie" region, and is therefore presumably less calcareous. Second, it flows through a very low and flat country* for the last sixty miles or so of its course, while the Alabama has rolling hills close to it all the way to its mouth† (and even beyond, for there are bluffs nearly 100 feet high on Mobile Bay).

Botanically also the Apalachicola presents many interesting features. On its eastern bank between the Georgia line and Bristol there are several high bluffs, which have been celebrated among botanists for three quarters of a century on account of being the home of two gymnospermous trees not known anywhere

* Described as the "Middle Florida flatwoods" in Ann. Rep. Fla. Geol. Surv. 3: 221–222. 1911.

† The railroad which crosses the estuarine swamps of the Apalachicola a few miles from its mouth, where they are five miles wide, goes on trestles all the way, presumably because the nearest hills from which earth could be obtained on a level with the cars are over 40 miles away; while the one which is similarly situated with respect to the Alabama River system crosses 15 miles of swamp, on earth embankments.

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else in the world, and a few other rare plants, as well as being the southern limit of quite a number of shade-loving species which are more common in the mountains a few hundred miles farther north.*

For nearly a quarter of a century geologists have been attracted to the same region by the splendid sections of certain Oligocene and Miocene formations exposed in these bluffs, some of which are over 150 feet high.† But the flat country between Bristol and the coast has been almost universally regarded by geologists as devoid of interest,‡ apparently because no fossils are found there. And except in the immediate vicinity of Apalachicola, at the mouth of the river, almost no botanical work has been done along the lower Apalachicola, perhaps chiefly because the flat country is very thinly settled and there are few accommodations for travelers along that part of the river.

Notwithstanding Drummond's botanical discoveries near Apalachicola in 1835,§ Dr. A. W. Chapman's residence there from 1847 to 1899, and the visits of several other botanists to the place during that period — all of whom must have traveled on the river in going or coming, for Apalachicola had no railroad until 1907 — no one hitherto seems to have thought it worth while to describe the vegetation observable from a boat on the lower portions of the river, and thus some significant and more or less important facts have never been brought to the attention of the public.

At noon on April 25, 1910, I embarked at Apalachicola on a commodious river steamboat bound upstream, and by nightfall

* See Gray, A pilgrimage to Torreya, Scientific Papers of Asa Gray **1**: 188–196. 1889) Curtiss, Tenth Census U. S. **9**: 521. 1884; Chapman, Bot. Gaz. **10**: 251–254. 1885; Cowles, Rep. 8th Int. Geog. Cong. 599. 1905.

† See Sellards & Gunter, Ann. Rep. Fla. Geol. Surv. **2**: 261–279. 1910; and several earlier papers there referred to. (On page 261, "middle west Florida" should read "western Middle Florida," and "from Gibson to Havana" [Florida] should be "near Fowlstown, Georgia." On page 266, "St. Andrews Bay" was evidently intended for Apalachicola Bay.)

‡ See E. A Smith, Tenth Census U. S. **6**: 226, 241. 1884; W. H. Dall, Bull. U. S. Geol. Surv. **84**: 95. 1892; Dall & Stanley-Brown, Bull. Geol. Soc. Am. **5**: 150. 1894.

§ Comp. Bot. Mag. **1**: 16. 1835; Sargent, Silva N. A. **7**: 110. 1895.

had traveled about fifty miles, or some ten miles above the mouth of the Chipola River.* Notes on the river-bank vegetation were taken all the way in the usual manner, mostly from the pilot-house, about 25 feet above the water, which afforded an ample view in all directions.

Near the mouth of the river it is bordered by extensive marshes based on soft mud.† A little farther upstream strips and patches of trees begin to appear in the marshes, increasing in size and

FIG. 1. Looking down Apalachicola River near Smith's Bend, about 25 miles above Apalachicola, showing swamp vegetation extending to water's edge. A few specimens of *Pinus glabra* visible at right.

abundance until within a very few miles the marshes are reduced to narrow and more or less interrupted strips of reed-like vegetation at the water's edge, which gradually disappear entirely. The banks at the same time become firmer and higher, but in this lower portion of the river there are very few places that can be called bluffs, and the trees nearly everywhere grow right down to the water. From the boat it was difficult to form

* The Apalachicola seems never to have been carefully measured like some of the other navigable rivers of the South, so that it is impossible to give exact figures.

† See Ann. Rep. Fla. Geol. Surv. **3**: 235. 1911.

any idea of the width of the swamps, there being no hills back of them.

No abrupt changes in vegetation or environmental conditions were noticed on this trip, but in order to bring out certain contrasts between the vegetation near the mouth of the river and that farther up I have divided my notes arbitrarily into two parts, selecting as the dividing point Owl Creek, which forms part of the boundary between Franklin and Liberty Counties, about thirty miles from Apalachicola by water.

In the following table the plants seen below Owl Creek and those seen above it are arranged in parallel columns, as was done with those of the Cretaceous and Eocene portions of the Warrior and Tombigbee Rivers last year.* The number prefixed to the name of each species indicates the number of times it was seen on that section of the river; those seen only once being omitted.

The country along the lower Apalachicola is so thinly settled that the effects of civilization on the river-bank vegetation, except for the removal of a good deal of *Taxodium distichum* by lumbermen, do not need to concern us at present. Almost the only works of man visible from a boat on this part of the river are lumber camps and a few apiaries, the latter being located there to take advantage of the abundance of honey furnished in spring by the two species of *Nyssa* listed below.†

The plants noted in the manner above described are as follows:

Below Owl Creek	Above Owl Creek
Trees	*Trees*
29 Taxodium distichum	42 Salix nigra
25 Salix nigra? ‡	22 Planera aquatica
18 Sabal Palmetto	22 Betula nigra
18 Nyssa uniflora	21 Liquidambar Styraciflua
17 Nyssa Ogeche	18 Taxodium distichum
8 Magnolia glauca	18 Nyssa Ogeche
8 Planera aquatica	14 Populus deltoides

* Bull. Torrey Club **37**: 113–115. 1910.

† See Sargent, Silva N. A. **14**: 101. 1902. Calhoun County, which forms the western bank of the river along the greater part of the route here described, is the banner honey county of Florida, producing annually about one-third of the crop of the whole state.

‡ Some of the willows seen in the first few miles may be another species which is widely distributed in Florida and passes at present for *S. longipes*.

6 Pinus Taeda
5 Pinus glabra
5 Liquidambar Styraciflua
3 Acer rubrum
3 Quercus lyrata
3 Populus deltoides
3 Betula nigra
2 Fraxinus profunda?†

Shrubs

9 Alnus rugosa
2 Sabal glabra

Herbs

22 Tillandsia usneoides
4 Zizania palustris?
4 Scirpus validus
2 Cladium effusum
2 Phragmites communis

14 Platanus occidentalis
12 Acer rubrum?*
11 Quercus nigra
8 Populus heterophylla
7 Nyssa uniflora
6 Fraxinus caroliniana?
5 Ulmus americana?
4 Quercus lyrata
4 Magnolia glauca
3 Sabal Palmetto
2 Quercus Michauxii
2 Hicoria aquatica
2 Gleditschia sp.
2 Carpinus caroliniana
2 Acer saccharinum

Shrubs and Vines

24 Arundinaria macrosperma
14 Sabal glabra
11 Vitis aestivalis?
11 Wistaria frutescens
8 Ampelopsis arborea
5 Brunnichia cirrhosa
5 Phoradendron flavescens
2 Itea virginica

Herbs

19 Tillandsia usneoides
6 Zizania palustris? ‡
3 Senecio lobatus

Before discussing the significant features of this table it will be in order to explain a few facts which the table does not show.

The two pines mentioned in the first column did not grow immediately on the banks of the river, but a short distance back, presumably on ground elevated a trifle above the swamps. The same might be said of a few of the species in the second column, such as *Quercus nigra* and *Carpinus*. *Betula nigra* and *Acer saccharinum*, here as elsewhere, seemed to be confined to the immediate banks of the stream, leaning out over the water. *Salix*

* See notes on this species in Ann. Rep. Fla. Geol. Surv. **3**: 322. 1911; also Bush, Gard. & For. **10**: 516. 1897.

† Or more likely the var. *tridens*, which seems to enjoy more alluvial habitats than the typical *A. rubrum*.

‡ Without flowers I could not be sure whether this large grass was *Zizania* or *Zizaniopsis*.

nigra, especially in the portions of the river farthest from its mouth, where the tendency to meandering is greatest, was almost confined to the inside of bends, where deposition of sediment is taking place most of the time. *Nyssa biflora*, which is very common in the estuarine swamps near the mouth of the river,* was not seen at all on the banks, perhaps because the water there is a little too swift or too muddy for it.

In dividing the notes at only one point in this way there is nothing to show the reader just where each species was first and last seen. But of the species in the first column, *Nyssa uniflora*, *Planera*, *Quercus lyrata*, *Populus deltoides*, and *Betula* have not been observed in the typical estuarine swamps, and were not seen until after passing through the railroad bridge about four miles above Apalachicola. Of those in the second column, *Nyssa Ogeche*, *Populus heterophylla*, *Magnolia glauca*, *Sabal Palmetto*, and *Zizania* are not found in the alluvial swamps above Bristol,† and perhaps do not grow on the banks of the river anywhere above the point where darkness put an end to my observations, which must be about thirty miles below Bristol.

Sabal Palmetto extends sparingly up the river to a little above the mouth of the Chipola, far enough to overlap *Platanus*, *Betula*, *Planera*, *Populus heterophylla*, *Arundinaria*, *Wistaria*, and *Brunnichia*. (There is probably no other place in the world where it associates with all these alluvial swamp plants, or even half of them.) *Magnolia glauca* as a river-swamp tree extends at least five miles above the mouth of the Chipola, but apparently not far enough to meet *Acer saccharinum*, which was not seen until about sunset. *Nyssa Ogeche* extends a little farther up, meeting *Acer saccharinum* about fifty miles from the coast, and probably nowhere else.

Planera, *Betula*, and *Populus deltoides* were first noticed about fifteen miles above Apalachicola, and *Populus heterophylla*, *Platanus*, *Quercus nigra*, *Arundinaria*, *Wistaria*, *Vitis*, *Brunnichia*, and *Ampelopsis* at about twice that distance.

Salix nigra, *Platanus occidentalis*, both species of *Populus*,

* Described in Ann. Rep. Fla. Geol. Surv. 3: 235–237. *pl. 19, 2. f. 17.* 1911.

† Ibid., 234–235. *pl. 19, 1.* 1911.

Nyssa Ogeche, *Acer saccharinum*, *Arundinaria macrosperma*, *Wistaria*, and *Brunnichia* probably extend farther south on this river than in any other part of their ranges; and several of these are not known on any other stream in Florida.*

Now for the interpretation of some of the returns shown in the table. On comparing the two lists it will be seen that herbs and evergreen trees (particularly *Sabal Palmetto* and *Magnolia glauca*) are more abundant in the lower portions of the river, and species of woody plants more numerous farther up, all of which seems to indicate that the vegetation near the mouth of the river is farther removed from the climax condition than that higher up. (Such statistics would not carry much weight if based on this one day's work alone, but I have observed similar relations on several other rivers.) Looking at the matter more closely from a floristic standpoint, *Fraxinus profunda*, *Alnus*, *Scirpus*, *Cladium*, and *Phragmites* were not seen at all after passing Owl Creek, and *Taxodium*, *Sabal Palmetto*, *Nyssa uniflora*, and *Magnolia glauca* were noticeably more abundant below there than above. On the other hand, *Platanus*, *Quercus nigra*, *Populus heterophylla*, *Ulmus americana*, *Gleditschia*, *Hicoria aquatica*, *Quercus Michauxii*, *Carpinus*, *Acer saccharinum*, *Arundinaria*, *Vitis*, *Wistaria*, *Ampelopsis*, *Brunnichia*, and *Itea* were not identified below Owl Creek, and *Salix nigra*, *Planera*, *Betula*, *Liquidambar*, *Populus deltoides*, *Fraxinus caroliniana*, *Sabal glabra*, and *Phoradendron* were seen considerably oftener in the second part of the journey than in the first, although the first was a little longer.

The explanation of all these differences between the vegetation near the mouth of the river and that a little farther up must be sought in one or more environmental or historical factors. The environmental differences between the two portions are of several kinds, among which may be enumerated the following:—

1. The upper reaches of the river, being farther north, presumably have a slightly cooler climate. But in such a short distance climatic differences due to latitude would hardly be

* *Salix nigra*, *Acer saccharinum*, both species of *Populus*, *Nyssa uniflora*, *Quercus lyrata*, *Betula*, and *Planera* are not mentioned in the most complete list of Florida plants extant, namely, that of Prof. A. S. Hitchcock in Trans. Kan. Acad. Sci. **16**: 108–157. 1899; **17**: 79–105. 1901.

perceptible, and some of the species confined to the second column (*e. g.*, *Arundinaria*, *Brunnichia*) are more "tropical" than some of those confined to the first (*e. g.*, *Alnus*, *Scirpus*, *Phragmites*).

2. The proximity of the Gulf of Mexico to the lower portions of the river might affect the climate there by making the summers more humid, or the winters milder, or both. Although this might perhaps be assumed to have something to do with the distribution of *Sabal Palmetto* or *Platanus*, it would not explain the abundance coastward of *Taxodium*, *Magnolia*, and *Alnus*, for those are equally at home much farther north and farther inland. Besides the differences due to this cause, like the first, would be very slight.

3. The water near the mouth of the river is of course a little more salty, and more affected by tides, than that farther up. But none of the plants in the first column are believed to have any particular fondness for salt, with the possible exception of *Sabal Palmetto* (whose habitat preferences are still a puzzle) and two or three of the herbs; and nearly all of them are common far inland, where there is no tide.

4. The farther one goes up the river, the higher and firmer the banks become. It may be that *Betula*, *Quercus Michauxii*, *Acer saccharinum*, and a few other trees require a solid footing, but many of the species which are abundant on the soft muck of the estuarine swamps grow just as well or even better on *terra firma* in the interior.

5. This region, like many other parts of the coastal plain, is supposed to have been submerged beneath the sea in comparatively recent times, geologically speaking, and of course the mouth of the river emerged last, which would tend to make the vegetation there more nearly of the pioneer type, if other things were equal. But we know too little as yet of the effects of geological history on vegetation, and besides, the region under consideration is so nearly level that it must have all emerged from beneath the waves almost simultaneously. If the plants along this river were not known anywhere else, then it would be difficult to separate the effects of history from those of some other factors, especially the one next to be described. But nearly all

the species in the first column are common enough at considerably higher altitudes, which have not been submerged for ages. That some of the species in the second column have not yet had time or opportunity to spread southward or coastward as far as the mouth of the river is still less likely.

6. All streams, the large muddy rivers especially, are subject to seasonal variations in volume. In times of flood every river at every point in its course must either rise (so as to increase the area of its cross-section), or flow faster, or both. But no flood can raise the level of the ocean appreciably; so the mouths of rivers are practically free from seasonal changes of level, and fluctuate only with the wind and tides. And these influences are comparatively slight at Apalachicola, which is protected by a barrier beach a few miles off shore.

The amount of seasonal fluctuation in any river of course increases upstream, to a certain point where the diminishing volume of water (or in some cases the greater slope of the channel) begins to offset it. (In the case of the Apalachicola River system the point of maximum fluctuation is far north of the portion under consideration, probably near the fall-line.) As the Florida portion of this river is navigable all the year round, it has not yet been considered necessary to measure its fluctuations, but making a rough estimate I should say that at the point where this excursion terminated the water varies in level about ten feet during the year.

There are doubtless other environmental factors concerned to some extent in the problem, but those discussed above seem to be most significant, and the last one by far the most important. All the available evidence seems to point to the conclusion that most of the swamp plants confined to the more inland portions of this and similar rivers simply require (or tolerate?) more seasonal fluctuation of water than do those of the estuarine swamps, and *vice versa*. In the last few years I have observed similar correlations between pioneer vegetation and constant water-level in so many other places, both on the coast and in bogs and non-alluvial swamps in the interior, that I am inclined to regard this principle as of universal application, at least in temperate and

moderately humid climates (which are the only climates I have thus far experienced). Just how and why fluctuations of water-level affect vegetation is a problem which belongs to ecology rather than to phytogeography, and it would require too much space to discuss it here.

University, Ala.

FOSSIL FLOWERS AND FRUITS

By T. D. A. Cockerell

The Miocene shales at Florissant, Colorado, are remarkably rich in flowers and fruits, some of which have already been described. Many others have remained unpublished, because I found it extremely difficult to determine their generic relationships with any degree of certainty. Some years ago, I took a series to Cambridge University in England, where they were much admired, but eventually returned to me with the remark that no one there felt able to describe them. I have been very unwilling to publish species of "*Antholithes*," "*Carpolithes*," etc., which could not even be referred definitely to particular families; but it is possible that by ignoring these specimens we may be missing some important evidence. Tertiary plants are nearly always referred to living genera, and it is at least certain that few if any distinct genera of plants have originated since the Miocene. It is quite a different question, however, whether any have become extinct since that time, and indeed it is practically certain that many genera have disappeared during the Tertiary. We know genera like *Sequoia*, which formerly were widespread and abundant, but now are restricted to small areas. The important genus *Ginkgo* would have disappeared entirely had it not been taken into cultivation. It is therefore quite reasonable to look for extinct genera in the Miocene, and if these really exist among our fossils, it is probable that the fruits and flowers will best indicate them. For such reasons as these it may be worth while to publish descriptions of unclassified flowers and fruits, which may be introduced as "*Antholithes*" and "*Carpolithes*," and perhaps correctly classified at some later date.

To propose a new generic name for each of these organisms would only create confusion, unless the author were so skilled in botanical taxonomy that he could say positively, no such plant as this exists today. I certainly do not possess such knowledge, but it may be that the inability of any and all botanists to recognize certain types will after a time appear to justify new generic names.

1. **Carpolithes macrophyllus** n. sp.

Fruit apparently consisting of woody follicles about 2.75 mm. long, so far as can be seen like those of *Lyonothamnus*; sepals four, persistent, about 16 mm. long, 4 broad in middle, elongate-lanceolate, apparently entire, with a single strong median vein and an irregular reticulate venation of the camtodrome type. The sepals are imperfect in various degrees, but enough is visible to permit a restoration as shown in the drawing.

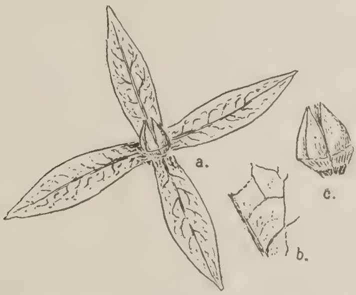

FIG. 1. *Carpolithes macrophyllus*. *a*, Whole fossil, the edges of the calyx-lobes restored; *b*, detail of venation; *c*, fruit.

Can this be Cunoniaceous? The follicles and persistent sepals agree, and while the hypanthium is 5-lobed in *Lyonothamnus*, it is 4 or 5-lobed in *Weinmannia* and other genera. I do not know any genus in which the sepals resemble those of the fossil, however. In connection with the Cunoniaceæ, it is to be remarked that *Lyonothamnus*, now restricted to the islands off the coast of California, must have been more widely distributed during the Tertiary. Its foliage is extraordinarily like that of the Proteaceous *Banksia*, and if it has occurred as a fossil it has probably been referred to that genus.

Among the described fossils, *C. macrophyllus* much resembles *Buettneria perplexans* Ckll., also from Florissant. *B. perplexans* has a five-lobed calyx, the lobes or sepals about 9.5 mm. long.

C. macrophyllus was found at Station 14, Florissant (*W. P. Cockerell*). The mollusc *Planorbis florissantensis* occurs on the same slab, about 25 mm. from the plant.

REVIEWS

Scott's Evolution of Plants*

This is one of the most fascinating and, at the same time, illuminating "popular" books on science that has appeared in some time; the style has a distinct literary value, and the statements have clearness and lucidity such as only a master can command. The scope of the book is much more restricted than the title indicates, for the subject of the evolution of plants is treated chiefly with reference to the fossil evidence (p. 20). The questions considered are (p. 21): (1) The evolution of the true flowering plants or angiosperms (Chapters II and III); (2) The evolution of the seed-plants generally (Chapter IV); (3) The evolution of the great groups of the higher cryptogams, *i. e.*, of those spore-plants which share with the seed-plants the possession of a vascular system (wood and bast) (Chapters V to VII).

It is of interest to note, in passing, the order of topics, as given above, which is a direct reversal of the order of evolutionary development. In view of the claim, now so frequently and emphatically urged, that any method of treatment of the subject matter of botany that departs from the supposed order of phylogeny is undesirable and "illogical," it is instructive to note the entire success of the author's inverse order of treatment. One could hardly claim, in seriousness, that the reader loses anything of either clearness or accuracy, by approaching, even for the first time, the history of development as here recorded.

Every specialist bemoans the neglect of his own corner by those who are absorbed in other corners, but it is doubtless

* Scott, Deunkinfield Henry. The Evolution of Plants pp. 1–256. *f. 1–25.* Henry Holt and Co., New York, and Williams and Norgate, London. 1911. (A volume of The Home University Library of Modern Knowledge.)

true that the very general neglect of paleobotany by botanists is most unfortunate. Lack of perspective always means distortion, and perspective in evolutionary botany is practically impossible without regarding the evidence offered only by fossil plants. The customary omission of any reference to this record in school text-books is responsible for the very common impression of students who have had only elementary courses that mosses are descended from liverworts, ferns from mosses, and gymnosperms from ferns. Many will realize for the first time, on reading this book, that the derivation of the leafy sporophyte from the sporogonium of the bryophytes is clearly not the only possible view, but that "the theory that the asexual plant of the higher Cryptogams was derived from a sporogonium is unsupported by [fossil] evidence." "The idea of the superior primitiveness and antiquity of plants of the Bryophyte type remains a pure assumption and receives no support from our knowledge of ancient vegetation" (p. 224). "On this theory, then, the sexual prothallus and the asexual plant are both alike derived from a thallus, and may once have been perfectly similar to each other; the one has gone up and the other down" (p. 226). The reviewer calls to mind more than one college text that contains not even a hint of this fossil evidence and the conclusion to which it leads.

Omissions of like kind, however, are chargeable to the book under review. In Chapter I, discussing the Darwinian theory, the mutation theory is absolutely ignored, and one reads (p. 13) with nothing short of amazement, that, "Natural Selection appears to be the only theory at present in the field, which can be said to give at all a satisfactory explanation, by means of natural causes, of the origin of adaptations." Of similar nature is the regarding of *Isoetes* as, without question, belonging to the Selaginellaceae. Again, in discussing the relation between the colors of flowers and insect visitation (pp. 41, 96–97), the recent work of Plateau and others receives no mention. Of course, in a popular book of restricted compass, one cannot go into a discussion of all the controverted questions of the specialist, but on the other hand, it hardly seems fair to the popular reader, to leave him, in such cases, with the impression that only the explanation or view given is held or tenable.

The terminology employed is about as simple and non-technical as accuracy would permit. For example, we read (p. 191) of club-mosses "with spores of one kind," where it would have been so easy to use the less-desirable technical adjective, homosporous. Especially valuable in a popular scientific work is the author's caution in inductive inference (*e. g.*, pp. 224, 228, 230, 237, and 239), emphasizing for the reader the necessity of suspending judgment in the light of insufficient data.

A genealogical tree would have added greatly to the already clear Conclusion, and two or three (at least) illustrations of fossil plants as they are found, imbedded in the rock, would have added much to the interest and value of the text, especially to the layman who is not already familiar with these in technical publications.

On page 135, we read that the old Linnean name, Cryptogams, indicated that the sexual reproduction of these plants was hidden, "which is no longer the case"! This last clause implies a sweeping morphological change which the author probably did not intend. The last sentence on page 189 reads as follows (italics mine): "On the *other* hand, nothing could be more different than the habit — tall trees on the *other* hand, and *dwarf-water* plants with a flat disc for a stem on the *other*." On page 7 evolution is defined as coextensive with organic evolution. *Tillandsia usneoides* ("old man's beard," or Florida Moss), ascribed on page 31 to "Western South America," is found from Eastern Virginia to Florida and Texas, and abundantly throughout tropical America.

In view of the fact that the book is issued by both an English and an American publisher, and therefore presumably intended for American as well as British readers, it is unfortunate that American geological formations are almost, if not quite, ignored. There is also no reference in the book to American paleobotanical contributions.

It is a pity that the publisher's work falls so far below the author's in point of merit. The book is printed on miserable paper, and either the proof-reading or the proof-correcting was not carefully done. The jumble of words composing most of

the fourth and fifth lines from the bottom of page 7 is a kind of error not uncommon in books from this American publishing house. Note also *carpets* for *carpels* (p. 70), *ony* for *only* (p. 71), *rotote* for *rotate* (p. 74), *snores* for *spores* (p. 125), *formed* for *found* (p. 130).

However, the reviewer does not wish to leave a final impression of the book out of harmony with the first sentence of this review. He feels under personal obligations to the author for this concise and clear summary of the contributions of paleobotany to plant evolution, and the volume is sure to meet with a well deserved and widespread welcome.

C. Stuart Gager.

Brooklyn Botanic Garden,
September 22, 1911

A rather rare publication,* scarcely known to most botanists, contains, among a mass of ethnologic material, considerable of botanical interest. From page 179 to 204 there is a list of the vernacular names, used by the Indians for the commoner plants of their region, together with their Latin equivalents. The list is arranged according to families in alphabetical sequence, a purely botanical device quite unknown to the Indians whose sole ideas of plants seem to be confined to knowledge as to whether they are good for anything, or not. A short introductory note has this to say of the Indians' knowlege of their flora. " By far most of the species are designated as 'aze,' medicine, and are known for their medicinal properties. It might be said, in truth, that this is the keynote to the plant lore of the Navaho, since non-medicinal plants are designated as "t'ō′ch'ĭl," or merely plants. On the other hand their observations of the medicinal properties have in reality accounted for the discrimination of the various species of plants, and while many of their 'medicines' are traditional only, tradition has preserved the name although the object, and often the significance of the word, is obtained with difficulty."

The foods and beverages, most of which are of plant origin

* An ethnologic dictionary of the Navaho language. Written and published by the Franciscan Fathers of the Navajo (*sic*) Indian Mission, Saint Michaels, Arizona. Pp. 1–536. [Illust.] 1910. Price $5.00.

are listed under their vernacular names (pp. 204–219). Many of the definitions in these lists contain much of interest to the ethno-botanist and mention is made here of the publication because only 200 copies were printed and very few, if any, found their way into botanical libraries.

N. T.

PROCEEDINGS OF THE CLUB

May 8, 1911

The meeting of May 8, 1911, was held at the American Museum of Natural History at 8:15 P. M., President Rusby presiding. Forty-five persons were present.

The minutes of the meeting of April 26 were read and approved. Dr. E. B. Southwick, chairman of the Field Committee, reported that the program of the field excursions had been completed and that the first two excursions in April had been attended by twelve persons, collecting 23 species of plants, 5 of which were violets.

Dr. N. L. Britton spoke of the advisability of changing the time of the regular Tuesday meeting to some other evening in order to avoid conflicting with other meetings held at the Museum on Tuesday evening.

The scientific program consisted of a lecture on "Violets" by Professor Ezra Brainerd. Numerous lantern slides were shown to illustrate the principles of Mendel's Law, and the crossing of species of violets, with the resulting hybrids. This lecture will be published in the Bulletin of the Club.

Meeting adjourned.

B. O. Dodge,
Secretary

May 31, 1911

The meeting of May 31, 1911, was held at the museum building of the New York Botanical Garden at 3:30 P. M. Vice President Barnhart presided. Ten persons were present.

The minutes of the meeting of May 8 were read and their approval deferred until the next meeting on request of the

secretary. The names of the following persons who had qualified as sustaining members of the Club were then read by the secretary: Dr. J. H. Barnhart, Hon. Addison Brown, James B. Ford, John Kane and Gustave Ramsperger. Miss Caroline C. Haynes and Mr. H. A. Cassebeer, Jr., have accepted the invitation to become sustaining members.

On motion of Dr. Britton the secretary was instructed to ascertain what action was taken by the Club in fixing the day of the Wednesday meeting and to report at the next meeting the method by which the day of a regular meeting may be changed.

The scientific program consisted of a paper on "Rubber-producing Plants" by Mr. B. T. Butler. The following abstract was furnished by the speaker:

"The rubber-producing plants of the world are confined largely to the following families: Euphorbiaceae, Apocynaceae, and Moraceae. The Asclepiadaceae, although very milky plants, has few species that yield caoutchouc. The Compositae has one genus, *Parthenium*, that yields the Guayule rubber of Mexico.

"The Euphorbiaceae is the most important family from a commerical standpoint as it includes the genus *Hevea* which produces the highest grade rubber—Para. *Hevea brasiliensis* Muell. is the best known of this genus. Pure Para rubber brings the highest market price. This species is largely cultivated in all tropical countries, supplanting the well-known *Ficus elastica* in the Far East.

"The genus *Sapium* is a near realtive of the *Hevea* and produces the White Rubber of the northern South American countries. *Sapium aucuparium* Jacq. does not "bleed" freely and the caoutchouc dries or coagulates naturally beneath the bark. This can be extracted by mechanical means.

"The family Moraceae includes the Ramboug, *Ficus elastica* Roxb., which produces a low grade rubber. The *Castilla* of Central America and Mexico, which yields a fine product is much cultivated.

"The Apocynaceae contains the lianes or tropical climbers.

The Rubber Tree of South Africa, *Funtumia elastica* Stapf., is the best known rubber tree of this family. *Alstonia scholaris* R. Br. of South Asia, *Dyera castulata* Hook. of the same region, *Dyera Lowii* Hook. of Borneo (the latter two producing the resinous product called Jelutong), *Mascarenhasia* sp. of Madagascar, and several species of *Plumiera* from Mexico are also trees that produce more or less rubber.

"Another family of scientific interest is the Celastraceae. Many members of this family possess special caoutchouc cells in the stems, leaves, and fruit. These plants do not "bleed" on cutting, but the threads of caoutchouc are found scattered throughout the plant tissues of recent growths and may be separated by mechanical means.

"Several tropical genera of Loranthaceae furnish rubber known as Mistletoe Rubber. They are of no commercial importance."

Dr. Marshall A. Howe exhibited a very beautiful and instructive series of dried specimens of marine algae from Monterey Bay, California, owned by Mr. H. B. Snyder of New York City. Comments upon the rare forms were made and some comparisons were instituted between these luxuriant well-prepared specimens and those that commonly find their way into herbaria.

Dr. W. A. Murrill then exhibited a recently collected specimen of *Arcturus borealis*.

Meeting adjourned to October 10, 1911.

B. O. Dodge,
Secretary

OF INTEREST TO TEACHERS*

General Science Courses

Among other views on general biology W. L. Eikenberry's article (*School Science and Mathematics*, September, 1910) mentions two facts that are not always recognized in framing such general courses. The first is related to the three part courses now popular as a first year course.

"The present tendency toward the use of 'immediately useful' or economic materials has stimulated the attempt to organize

* Conducted by Miss Jean Broadhurst, Teachers College, Columbia University.

the old materials of general biology about human hygiene in order to give some sort of continuity to the whole. Just what real connection the teachers may in practice succeed in giving to such a course it is not the province of this paper to present; but upon the face of the printed courses and texts it would appear that the result has been to add to the old dual course a third element already familiar in the schools as human physiology. That there is actually more connection between the parts than appears on the surface is doubtless true, but such connection is dependent upon the personal equation of the teacher and exists rather in spite of the formal organization of the materials than in consequence of it. With respect to the texts, it is interesting to note that the three parts may be so wholly independent that they are issued without change, separately bound, for use in those schools in which only one of the sciences is taught. The old authors with their natural history have in many respects come closer to a solution than we with our biology."

The second shows that the unification of such courses has its difficulties and disadvantages. After showing that botany and zoölogy are divergent rather than parallel sciences, the selection of man as the unifying object is discussed, "The increasing interest in the economic phases of the sciences has stimulated the suggestion that the grouping of materials might be made about man's interest and activity, relating everything to man's use and regarding everything from the point of view of its utilization by him. This certainly has the advantage over former courses that a coherent classification is possible, and that the course can be organized as a unit. It is open to doubt, however, whether such a self-centered arrangement of the pupil's environment is desirable either scientifically or pedagogically."

Mr. Eikenberry thinks that there "is the further disability that when a science is organized with reference to man's more or less random utilization of its materials, such great gaps are left in its structure that it becomes merely a collection of unrelated fragments; it ceases to be a science. The most heterogeneous things are often brought together by man for his purpose as when a building is constructed of burnt clay, limestone, hair, pine

wood, sheet iron, and a multitude of equally diverse materials. If these things be studied from the viewpoint just mentioned any knowledge of those characteristics which are not intimately connected with their availability as structural materials is merely a collection of fugitive items without relation or connection. The mind may become stored with 'a thousand wonders of land and sea' but if these facts be unrelated and unconnected its condition is after all somewhat comparable to that of a dictionary which an acquaintance of mine described as 'mighty interesting reading but powerful disconnected.'

"Unrelated facts are of course unexplained and such a mass of highly interesting information is known only in an empirical way as much of it was known long before the birth of the sciences. If a science is to be taught the gaps must be filled up in such manner that the knowledge will be, if not continuous, at least orderly. This does not necessitate the omission of the materials selected from everyday life and related to human needs but it does require a careful selection among these and the addition to the 'practical' materials thus selected of those more practical materials which are fundamental to an understanding of the field and from which most of the practical scientific knowledge has arisen."

The conservation policies as established under the Roosevelt administration have been strengthened by two recent decisions of the Supreme Court. Both cases dealt originally with grazing on national reservations. Because of the arguments brought forward, the decisions do more than protect the forest reservations in these cases; they close the State's rights refuge to the enemies of conservation; and the second does away with the squabble over delegating legislative power by Congress, affirming that there are certain powers that Congress can either exercise or delegate, and that when it does delegate these powers it does not change their character from administrative to legislative by making the violation punishable.

Seven addresses on botanical teaching were made at the Minneapolis meeting in December (A. A. A. S.; *Science*, April 28).

Professor Charles E. Bessey discussed the preparation of botanical teachers; Professor O. Caldwell, the product of our botanical teaching; Professor F. E. Clements, methods of botanical teaching; discussion by Professor John M. Coulter and Frederick C. Newcombe followed. Professor Bessey regretted the passing of the old type of field botany, and that nothing in the present courses really takes its place; he also notes the heavier requirements of botanists for the college degrees in botany, when compared with the demands in other sciences and suggests that we are "putting too high a value on what we are putting into our students, and neglecting the man himself." Professor Caldwell (these abstracts are not complete in any sense) felt that we "need more students who early in life have begun to *think botany* and to think in the scientific method." Professor Clements noted the "failure of botany to provide a definite avenue to a position such as is offered by courses in law, medicine, engineering," etc.; he also regretted the specialized tendency that permeates nearly all elementary botanical teaching, feeling that even the microscope is "far too special an instrument for the beginner."

The English government has voted $250,000 for agricultural research, including plant and animal physiology, pathology, and breeding, and agricultural zoölogy, and fruit breeding. This appropriation is accompanied by a yearly sum of $15,000 for special investigation. The scheme includes grants to various educational institutions (a separate subject to be treated by each institution receiving aid) for investigation and scientific advice to farmers.

Professor Forrest Shreve has experimented with the giant cactus (*Carnegiea gigantea*) working out the influence of low temperatures on its distribution. The paper includes curves showing the daily rise of internal temperature in the giant cactus on a cold day.

The chief factors limiting the northward range of sub-tropical species are: "the greatest number of consecutive hours during which the temperature falls below freezing; the total number of

hours of frost in a single winter; the absolute minimum reached and the length of the winter, reckoned from the first frost of autumn to the last one of spring." The first and third are considered the most important; and Professor Shreve states that the "occurrence of a single day without mid-day thawing, coupled with a cloudiness that would prevent the internal temperature of the cactus from going above that of the air, would spell the destruction of *Carnegiea* and the parallel evidence of the climatological records and of the experiments which have been described appears to explain the limitation of its northward distribution."

A Cornell pamphlet by T. L. Lyon and J. A. Bizzell on a heretofore unnoted benefit from the growth of legumes states that the fact that "a legume may benefit a non-legume growing with it, by causing the non-legume to contain a larger quantity of nitrogen or protein, seems never to have been ascertained."

Alfalfa, red clover, peas, timothy, and oats were the principal plants used in the experiments described . Timothy grown *with* either alfalfa or clover showed a large increase per ton (50 pounds grown with alfalfa, 160 with clover) in protein content; oats with peas showed a gain also. These legume-bearing soils also contained more nitrates *after* the crops had been removed. Alfalfa formed nitrates much more rapidly than clover — the rate being, of course, an important factor in relation to the removal of nitrates by roots and by drainage. Alfalfa soils (five years' growth) contained more nitrates than similar timothy soils. Lime, it was demonstrated, improved the protein content of alfalfa and of non-legumes.

The United States Bureau of Education has issued a Bibliography of Science Teaching (No. 446) compiled by a committee of the American Federation of Teachers of the Mathematical and Natural Sciences. The citations have been carefully verified, and it makes a valuable contribution to science teaching.

Pennsylvania has begun a systematic campaign against the

chestnut blight. Up to 1911 the Department of Agriculture estimates the country's loss at $25,000,000. In Pennsylvania there are large areas not yet invaded by the chestnut disease, and $275,000 have been appropriated for studying and combating the disease.

An anti-frost candle has been added to the protective devices (smudges, oil heaters, firepots, etc.) for fruit trees. The candles contain a slow burning substance and can be suspended near the fruit, distributing heat at the level most needed.

The state board of education of Utah has recently ruled that every high school which receives support from the maintenance fund provided for high schools must teach agriculture. Utah is probably as good a state as any in which to enforce the teaching of agriculture; not only because of the proportion of farm land, but because of the peculiar conditions attending western farming. Nevertheless, such legislation is hardly the best thing for any new subject. This is particularly true of agriculture which to be well taught demands a good biological foundation and some practical experience. Compulsory adoption of a new subject forces poorly prepared teachers into the work, and is a disadvantage which wise advocates — even the most enthusiastic — would try to avoid.

It is to be hoped that the Utah provisions are in the form of an increased appropriation for such schools as include agriculture in the curriculum, and not an enactment making it compulsory upon pain of losing the entire state appropriation.

In repeating some of Overton's plasymolysis experiments with living cells Professor W. T. V. Osterhout (*Science*, August 11) finds that the "usual methods of determining osmotic pressure by plasmolyzing in salts of Na and K is very erroneous. Salts of Ca give more nearly the true osmotic pressure."

Solutions of calcium chloride and sodium chloride — each too weak to cause plasmolysis — caused very prompt and strong plasmolysis which mixed together; this indicates that "it is unsafe

to use the common method of adding a toxic to a non-toxic substance and judging the penetration of the former by the plasmolytic action of the mixture." Among other of Osterhout's conclusions is the proteid (and not lipoid) nature of the cell membrane.

W. H. Blanchard, who has described more than forty species and forms of *Rubus* during the last few years, writes in the September BULLETIN thus: "I venture to say and say with confidence, that eight species include the great bulk of our blackberries, perhaps ninety per cent. of them."

NEWS ITEMS

Dr. Bradley M. Davis, formerly of Cambridge, Mass., has been appointed assistant professor of botany at the University of Pennsylvania.

We learn from the *Evening Sun* (Oct. 19) of the resignation of Dr. M. T. Cook as plant pathologist for the State of Delaware and Delaware College, to accept a similar position with the State of New Jersey and Rutgers College.

Dr. N. L. Britton was the host at a dinner given on October 23, 1911, in honor of Professors W. L. Johannsen, R. H. Harper, W. G. Marquette and Mr. A. B. Stout. The staffs of the Columbia University, Barnard College, College of the City of New York, Normal College, New York Botanical Garden and Brooklyn Botanic Garden were present.

Dr. W. H. Brown (Hopkins '10) has gone to Manila as botanist to the Philippine Bureau of Science.

At the New York Botanical Garden Mr. A. B. Stout has been appointed director of the laboratories to succeed Mr. F. J. Seaver who has been appointed a curator. Dr. W. A. Murrill has gone to the Pacific coast to collect fleshy fungi.

Mr. C. A. Schwarze has been appointed an assistant in botany at Columbia University.

TORREYA

December, 1911

Vol. 11 No. 12

LIST OF PLANTS COLLECTED ON THE PEARY ARCTIC EXPEDITION OF 1905–06 AND 1908–09 WITH A GENERAL DESCRIPTION OF THE FLORA OF NORTHERN GREENLAND AND ELLESMERE LAND

By P. A. Rydberg

1. General Description of the Flora*

By the courtesy of the American Museum of Natural History, New York City, two small collections of arctic plants were turned over to the New York Botanical Garden. These collections were made on two of the Peary arctic expeditions in search of the North Pole. The first and smaller was made on the expedition of 1905–06 by Dr. L. J. Wolf; the later and larger in 1908–09 by Dr. J. W. Goodsell. The two collections number together 60 species of flowering plants and ferns. Dr. Goodsell's collection contained 95 numbers, but as he collected at five different places many of the species were represented by more than one number. Except of a few common species the duplicates were not many. Some of the most striking or most characteristic of the plants were exhibited at the American Museum of Natural History at the Peary Exposition last year. The principal set

* Most of this article was given as a paper before the Torrey Botanical Club last year. Although the writer has never visited the arctic regions, more than half of the species discussed are familiar to him from either the Scandinavian mountains or the alpine regions of the Rockies. The general description and the statistics are furthermore abstracted from two excellent works, not generally accessible, viz., Meddelelser om Groenland, found only in a few libraries in this country and printed in Danish, and the still rarer The Vascular Plants in the Flora of Ellesmere Land, by H. G. Simmons. As descriptions of the arctic regions are very rare, especially in English, it seemed advisable to print this paper in connection with the list.

[No. 11, Vol. 11, of Torreya, comprising pp. 225–248, was issued 10 November 1911.]

is preserved at the New York Botanical Garden, and smaller sets were distributed to Dr. Goodsell, the United States National Museum, the Philadelphia Academy, and the Field Museum, Chicago. As said before, Dr. Goodsell's collection was made at five different stations. Of these three are in Greenland, viz: (1) in the vicinity of North Star Bay (latitude 76° 32′), August 3–6, 1908; (2) in the vicinity of Cape Saumarey (latitude 77° 51′), August 8, 1908; (3) in the vicinity of Etah (latitude 78° 20′), August 6–18, 1908. One station was in the vicinity of Cape Sheridan, Grant Land (latitude 82° 30′), June 15 to July 17, 1909, and the last in a ravine near Battle Harbor, Labrador. All the specimens collected by Dr. Wolf were gathered on the north shore of Grant Land.

It would not be out of the way to say something about the country from which these plants came. Greenland is an island about 23° long and over 50° wide. Of course, at that latitude the degrees of longitude are very narrow. The land is very high on the eastern side. Most of the interior is completely unknown, but many mountains towering over 10,000 feet are known to exist and Petermann's Mountain is estimated at 11,000 feet. The mountains on the west side are evidently lower, the highest known about 5,400 feet. The whole interior is covered with ice or snow. The country evidently slopes somewhat from east to west as the glacier seems to bring more ice down on this side. So far as I know only three expeditions have been made across the country, one in the extreme north by Peary and two in southern Greenland. None have been undertaken in the central portion, which is much higher. A cross country ride in this portion would be a much more strenuous undertaking than Peary's trip to the pole or even Shackleton's travels in search of the South Pole.

The eastern coast, especially the part directly opposite Iceland, is practically unknown.* No vessel has been able even to get near the coast in the last two centuries. There are traditions telling of two settlements made hundreds of years ago from Ice-

* A few expeditions to this part have been undertaken recently, but the reports, if any, have not reached our libraries.

land, and Hans Egede, the first missionary among the Greenland Eskimos, has indicated on his map two churches on the east coast. If there existed any settlement here at Egede's time or not, we do not know. Egede never visited this part of Greenland. He, as well as his son Paul, spent most of his life to an old age among the western Eskimos. One expedition was made some years ago by the Danes and Norwegians along the eastern coast to the part where these old colonies were supposed to have been, but no traces of them were found. At present all the Danish colonies are on the western coast. The most northern one with regular communications, Upernavik, is situated near the 73° parallel, although there is a trading post at Tasinsak about one degree further north. The most northern Eskimo settlement is at Etah near 78° latitude.

The permanent inland ice reaches nearly to the coast and it is only a small strip of the mainland and the islands which become uncovered in the short summer, and it is only where glaciation or erosion has ground the rocks into gravel, sand, or dust, that there is any vegetation at all.

Ellesmere Land is an island situated west of North Greenland, and separated from it by Smith Sound, Kennedy Channel, and Robeson Channel. Kane Basin and Hall Basin are wider parts between the three channels. Ellesmere Land is situated between latitudes 76° and 83°. As several deep bays cut into this island both on the east and the west side, different portions of the same have received different names. The southeastern portion, the one first discovered, received the name Ellesmere Land, the middle portion Grinnell Land, and the northern portion Grant Land. The southern coast has been known as North Lincoln and the southwest end King Oscar Land. As Ellesmere Land was the first name applied to any portion of it by Europeans, it has been adopted for the whole island by the Canadian government. The oldest name is probably "Umingma nuna," the land of the muskoxen, as the Eskimos call it.

Ellesmere Land is not so high as Greenland, the highest point only a couple of thousand feet. There is no continuous inland ice as in Greenland, although smaller ice fields, snow-

covered mountains, and glaciers are found. The flora would probably be much richer if the soil were not so poor and the water supply so limited. In the northern part there is a large fresh-water lake, Lake Hazen.

In the accounts of the flora of Greenland and Ellesmere Land we seldom find any references to the altitude at which the plants grow. Simmons, in his flora of the latter, accounts for this. The occurrence of higher vegetation depends wholly upon soil and moisture. He says: "even at heigths of a thousand feet or more, there would be a flourishing vegetation, if only the other conditions were favorable. In few places have I seen such tall grasses as in the plateau of the peninsula between Goose Fjord and Walrus Fjord, at a height of more than 1,000 feet, and often, when after climbing a steep slope of some hundred or a thousand feet, which was very bare except for mosses and lichens, one arrived at a ledge or plateau, one would find a vegetation, which was not any poorer than that near the sea."

West of Ellesmere Land there is another large island, Heiberg Land, perhaps half as large. The flora of this is probably the same as that of Ellesmere Land. This island is practically unknown and no collection of botanical specimens has been made there.

The Labrador coast is very rocky and barren. The inland highland is practically unknown. All botanical collections made in Labrador have been made on the coast, but as Labrador belongs to the subarctic instead of the arctic regions I shall not characterize its flora here. I may only mention that Dr. Goodsell collected here an undescribed plant, of the parsnip family. This was submitted to Dr. J. N. Rose of the United States National Museum, who has furnished a description of it. It belongs to the genus *Conioselinum*.

Greenland has only one plant that forms a tree, *Betula odorata tortuosa*, of which one specimen has been found with a trunk 10 inches in diameter and 12 feet high. It is found as a small tree only at latitude 61° and south thereof, at about the same latitude as Upsala in Sweden, where there are forests of oaks, basswood, and choke cherry. The pine and spruce forests

extend to nearly the farthest point north on the Scandinavian peninsula, *i. e.*, almost to latitude 72°. This is mentioned to show the difference in temperature and climate between northern Europe and the same latitude on this side of the Atlantic. The gulf-stream ends north of Norway and the polar current skirts the east coast of Greenland.

The northern Swedish-Norwegian barley has been tried on Greenland but has failed to ripen even in the most southern part. At all the Danish colonies they have tried to grow gardens to some extent. In the Upernavik district they have failed altogether. At Umanak, near latitude 71°, they can grow green cabbage and radishes and a little lettuce, which does not form heads however. At Ritenbank, near latitude 70°, turnips and dwarf parsley are added. When the country settlers around Godthaab, latitude 64°, go to town, that is the trading post, they bring with them small bouquets of parsley as special gifts to their friends. In the most southern part peas have been grown large enough for the table although they do not ripen. Here there have also been some successful attempts to grow potatoes. But this part of Greenland is outside of the polar circle.

When the vegetable fare is so meager in the Danish colonies what would it be at Etah north of latitude 78°? Of course, none of our vegetables can be grown, and the native plants fit for food are very few. The only berries reported so far north are the crowberry, *Empetrum nigrum*, scarcely used as a food by white people, and a small blueberry, *Vaccinium uliginosum microphyllum*. The alpine blackberry, *Mairania alpina*, stops at latitude 70°, the common bearberry, *Arctostaphylos Uva-ursi* at 66° 40′, the so-called mountain cranberry, *Vaccinium Vitis-idaea* at 76°, the small cranberry, *Oxycoccus Oxycoccus microphyllus*, at 64° 30′, the blueberry, *Vaccinium uliginosum*, at 64°, the cloudberry or baked-apple-berry, *Rubus Chamaemorus*, at 64° 15′, the dwarf red dewberry, *R. saxatilis*, at 63° 30′. The only plants that can be used for food in the neighborhood of Etah and on Ellesmere Land are *Rhodiola rosea*, a species of stonecrop, of which the thick red root is eaten, mountain sorrel,

Oxyria digynia, of which rootstock and leaves are used, and two species of scurvy-grass, *Cochlearia groenlandica* and *C. fenestrata*, of which the foliage is used. The flower spikes of a lousewort, *Pedicularis lanata*, are also eaten. Among the food plants of more southern parts of Greenland may be counted *Archangelica officinalis* and *Chamaenerium latifolium*, the latter a relative of our fireweed.

As said before, there are no trees in northern Greenland nor in Ellesmere Land. The woody flora consists of a few low bushes and undershrubs. *Betula flabellifolia* extends north to latitude 72°, the other dwarf birches are confined to southern Greenland. Two willows, *Salix groenlandica* and *S. anglorum*, are found in the whole of Greenland and in Ellesmere Land; the latter also throughout arctic America. One sterile specimen collected by Dr. Wolf on Grant Land seems to be *S. arctica*, not known from this region before. *S. herbacea* extends in Greenland north to 76° and *S. glauca ovatifolia* to 72°. The other Greenland willows are confined to the southern portion. None of them are found in Ellesmere Land.

The other undershrubs are the crowberry, *Diapensia lapponica*, and members of the heath and huckleberry families, all mentioned above except *Cassiope tetragona*. A few degrees south of Etah a few more are added, as for instance, *Phyllodoce caerulea*, *Andromeda polifolia*, *Cassiope hypnoides*, *Chamaecistus procumbens*, *Rhododendron lapponicum*, and *Ledum decumbens*. In Ellesmere Land the woody vegetation consists of the three willows mentioned above, *Diapensia lapponica*, *Vaccinium uliginosum microphyllum*, *Cassiope tetragona*, and *Empetrum nigrum*.

Nearly all of the plants of northern Greenland and Ellesmere Land are perennials. The majority are densely tufted or matted plants, some of them making large carpets. Among these can be counted many of the saxifrages and crucifers. Others have rootstocks, often thick and fleshy, as *Rhodiola rosea*, *Oxyria digyna*, several species of *Pedicularis* and *Taraxacum;* sometimes these are more slender, as the species of *Ranunculus*, the sedges, and the grasses.

Lange, in his Conspectus Florae Groenlandicae, enumerates about 400 species of flowering plants, but of course the larger number of these are confined to the southern portion. Simmons, in his Vascular Plants of Ellesmere Land, enumerates 107 phanerograms. Of these about a dozen are not found in Greenland. There are, however, perhaps a score of species found in northern Greenland not found in Ellesmere Land, and a few have been added since Simmons's publication, so that the North American flora north of latitude 72° may be estimated to about 160 species. Of these about three fifths are circumpolar plants, *i. e.*, plants common to arctic America, Spitzbergen, and Siberia. Of the remaining two fifths, at least half are plants common to arctic America, and the rest divided between truly endemic plants of this region and such as are of European origin, *i. e.*, common to Greenland and Iceland or Spitzbergen.

The families represented in the flora of Ellesmere Land and that of Greenland north of the Danish colonies (*i. e.*, north of latitude 72°) are as follows:

Gramineae	20	19	Rosaceae	5	7
Cyperaceae	15	19	Empetraceae	1	1
Juncaceae	3	6	Onagraceae	1	1
Melanthaceae	0	1	Pyrolaceae	1	1
Salicaceae	3	6	Ericaceae	1	7
Betulaceae	0	1	Vacciniaceae	1	2
Polygonaceae	2	3	Diapensiaceae	1	1
Portulacaceae	0	1	Primulaceae	1	0
Alsinaceae	7	11	Polemoniaceae	0	1
Caryophyllaceae	3	4	Plumbaginaceae	1	2
Ranunculaceae	6	8	Boraginaceae	0	1
Papaveraceae	1	1	Scrophulariaceae	4	6
Cruciferae	13	17	Campanulaceae	4	1
Crassulaceae	0	1	Compositae	4	8
Saxifragaceae	12	12	Cichoriaceae	3	2
				110	151

Of these there are 44 species reported for northern Greenland and not for Ellesmere Land, and 12 for the latter that are not found in the former. In the two together there are hence 163 species reported. The Eskimo settlements of Etah and vicinity, visited by the Peary expeditions, are situated between latitudes 76° and 78°, and no plants were collected farther south than 76°

30′ except those collected in Labrador. If 76° north latitude would be taken as the southern boundary instead of 72°, I think that the flora of the region would not comprise 100 species in all, as most of the additional Greenland species mentioned above have been recorded only a little north of 72°, and a few of the Ellesmere Land species are limited to the extreme southern portion of that island.

The grasses are all low and not very abundant. Of course, none of them could be used for hay, though they constitute an important part of the summer food for muskoxen and hares. The principal food for the former consists, however, of lichens and mosses. The grasses can be classified into two kinds: (1) The bunch grasses with very short rootstocks and sending up numerous branches from inside the lower sheaths. (2) Those with long stoloniferous rootstocks, forming sods like the Kentucky bluegrass. The former are growing in the gravel beds and among rocks, the latter in richer and moister soil around brooks and springs and below melting snowdrifts.

The sedge family is represented by two species of cotton grass, *Eriophorum*, one species each of *Kobresia* and *Elyna*, the latter genera closely related to the true sedges, *Carex*. The rest of the family consists of species of the latter genus. Most of them grow in the wetter places and have rootstocks.

The Juncaceae, the rushes, are represented by one species of *Juncus* in Ellesmere Land and two in northern Greenland, two species of *Juncoides* or *Luzula* in the former and four in the latter.

No other family of the monocotyledons is represented in Ellesmere Land, except Melanthaceae by one species, *Tofieldia palustris*, in northern Greenland.

The willow family has three representatives in Ellesmere Land and six in northern Greenland. All are low undershrubs. So also is the only representative of the birch family in northern Greenland, viz., *Betula flabellifolia*.

The representatives of the buckwheat family are *Oxyria digyna*, as stated before, one of the food plants, and *Polygonum viviparum*, a common alpine-arctic species. The third representative in northern Greenland is an introduced weed, one of the sorrels, *Rumex Acetosella*.

Montia fontana, a spring plant, *i. e.*, growing in springs, represents the purslane family in northern Greenland.

The chickweed family has seven representatives in Ellesmere Land and eleven in northern Greenland. Except the two species of *Cerastium*, they are very modest looking plants with small flowers and all forming small mats.

The pink family consists of the moss pink, *Silene acaulis*, common also on the higher mountains of this country and Europe, and three species of *Lychnis* or *Wahlbergella*.

The crowfoot family is represented by species of *Ranunculus*, all growing in wet places, especially under melting snow drifts; some of these are rather showy.

The most showy plant of the region is the arctic poppy, *Papaver radicatum*. It is rather strange that this genus, belonging principally to warmer countries, should have furnished the plant that above all gives color to the arctic flora. The common poppies of the gardens, the opium plant of India, the wild poppies of central Europe and California, are all leafy-stemmed annuals, but there is a small group of poppies of the arctic and alpine regions, which are perennials with short cespitose rootstocks, crowned by a cluster of finely dissected leaves and naked flower stalks. The stemmed poppies of warmer regions have mostly red, purple, pink, or rarely white flowers. The alpine-arctic poppies range from orange through yellow to white. *Papaver radicatum* is common through arctic Europe and America, in the Scandinavian mountains, on Iceland, and in our Rocky Mountains as far south as Colorado. Two closely related species are found in the Alps, another in the Pyrenees, another in the Caucasus, another in the Canadian Rockies and Montana, and two more in Alaska and eastern Siberia. If I do not remember incorrectly, the group is also represented in the Altai Mountains and the Himalayas.

The mustard family is represented by several species of *Draba*, two species of *Cardamine*, two of *Arabis*, two of *Cochlearia*, and one species each of the genera *Lesquerella*, *Eutrema*, *Braya*, and *Hesperis*. The species of *Cochlearia* are interesting, not only from the fact that they are used for food and as a remedy against

scurvy, but more so from the fact that they are, so far as I know, the only annuals of the region.

The only representatives of the stonecrop family is *Rhodiola rosea*, the root of which is eaten. It is not found in Ellesmere Land.

All the representatives of the saxifrage family belong to the genus *Saxifraga*, in the broader sense, except *Chrysosplenium tetrandrum*, collected at one station in southern Ellesmere Land.

The rose family is represented by one species of *Dryas* in Ellesmere Land and two in Greenland. The other members of the family belong to the genus *Potentilla*, all low and tufted species.

The crowberry, *Empetrum nigrum*, is the only representative of its family. The evening primrose family is represented by *Chamaenerium latifolium*, a close relative to our fireweed, and the wintergreen family by *Pyrola grandiflora*. The heath family is represented in Ellesmere Land by a single species, *Cassiope tetragona*, but in northern Greenland by six more species of the genera *Phyllodoce*, *Andromeda*, *Cassiope*, *Chamaecistus*, *Rhododendron*, and *Ledum*.

The huckleberry family has one representative in Ellesmere Land, *Vaccinium uliginosum microphyllum*, and an additional one in northern Greenland, *V. Vitis-idaea pumilum*.

Diapensiaceae is represented by *Diapensia lapponica* in both countries, Primulaceae by *Androsace septentrionalis* in Ellesmere Land, and Polemoniaceae by *Polemonium humile* in northern Greenland.

The Plumbago family is represented by one species of *Statice* in Ellesmere Land and two in Greenland. The only representative of the borage family is *Pneumaria maritima* in North Greenland.

All the representatives of the figwort family belong to the genus *Pedicularis* in the broad sense.

The harebell family is represented by *Campanula uniflora* alone.

The sunflower family is represented in Ellesmere Land by two species of *Erigeron*, one of *Antennaria*, and one of *Arnica*.

The additional species in North Greenland are one species of *Erigeron*, two of *Gnaphalium*, and one of *Artemisia*.

All four members of the chicory family belong to the genus *Taraxacum* of which the dandelion is a member. Of these one has not been found outside of Ellesmere Land and North Greenland, two more are found only there and in arctic America, while the fourth (not found in Ellesmere Land, nor America) is common to Greenland, arctic Europe, and Asia. All four of the arctic dandelions are now represented in the herbarium of the New York Botanical Garden. A few years ago we had only one. Two more were collected by Dr. Wolf and the last one by Dr. Goodsell.

New York Botanical Garden

(*To be continued*)

NEW COMBINATIONS FROM THE GENUS EUPHORBIA

By J. C. Arthur

The rusts inhabiting the several species of the genus *Euphorbia*, as ordinarily understood, have been variously treated by mycologists. In the recent monograph of the genus *Uromyces* by Sydow, the North American forms having aecia, uredinia and telia are segregated under four species, following the authority of Tranzschel, who in turn based his studies largely upon the published results of cultures made by the writer. In the treatment of this group of rusts in a forthcoming number of the North American Flora, the writer proposes to consider the four species recognized by Sydow as representing "physiological species," or races, belonging to a single species of rust. As these races conform fairly well to the genera into which the genus *Euphorbia* has been segregated, the writer further proposes to use the names of the segregates, rather than list all the hosts, about thirty-five, under the genus *Euphorbia*. A few of these species have not yet been transferred to the segregated genera, and rather than make the transfer of phanerogamic names in a work devoted to fungi, the present method is taken to place the

names on record where phanerogamic botanists may readily find them.

All the changes have the approval of Dr. Charles F. Millspaugh, who has passed upon all my material. His departure some time since upon a trip around the world made it impossible for him to publish the names, or even prepare the article. I am, therefore, assuming the responsibility, and propose the following changes:

Adenopetalum gramineum (Jacq.) Arth. *Euphorbia graminea* Jacq. Select Am. 151. 1763.

Chamaesyce arizonica (Engelm.) Arth. *Euphorbia arizonica* Engelm. in Torrey, Bot. Mex. Bound. 186. 1858.

Chamaesyce hirsuta (Torrey) Arth. *Euphorbia hypericifolia hirsuta* Torrey, Comp. 331. 1826. *E. hirsuta* Wiegand, Bot. Gaz. **24**: **50**. 1897.

Chamaesyce lasiocarpa (Klotz.) Arth. *Euphorbia lasiocarpa* Klotz. Nov. Act. Nat. Cur. Suppl. **19**: 414. 1843.

Chamaesyce pilosula (Engelm.) Arth. *Euphorbia pilosula* Engelm.; Boiss. in DC. Prodr. **15**[2]: 39. 1866.

Chamaesyce Preslii (Guss.) Arth. *Euphorbia Preslii* Guss. Fl. Sc. Prodr. **1**: 539. 1827.

Chamaesyce potosina (Fernald) Arth. *Euphorbia potosina* Fernald, Proc. Am. Acad. **36**: 495. 1901.

Poinsettia strigosa (Hook. & Arn.) Arth. *Euphorbia strigosa* Hook. & Arn. Bot. Beech. Voy. 310. 1837.

Zygophyllidium biforme (S. Wats.) Arth. *Euphorbia biformis* S. Wats. Proc. Am. Acad. **18**: 151. 1883.

As the three species, *C. Preslii*, *C. hypericifolia* and *C. nutans*, are usually grouped in current literature under one name, and differential descriptions are not available, Dr. Millspaugh at my request has supplied the following key.

Inflorescence glomerate.
 Leaves obtusely serrate, long-pilose at base; seeds black or blackish. *C. Preslii.*
 Leaves sharply serrate, not long-pilose at base; seeds red or reddish. *C. hypericifolia.*
Inflorescence solitary. *C. nutans.*

The first two species occur throughout the United States and Canada, the last species does not occur in the United States or Canada, but is found in the West Indies and Mexico.

PURDUE UNIVERSITY,
LAFAYETTE, INDIANA

ANOTHER RESPIRATION EXPERIMENT

BY JEAN BROADHURST

For two years we have been using the following device for showing that green plants give out CO_2. Many methods have already been described; this is added only because it is so easily put up and because the contrast with the control is most marked. An air-tight joint made with water is more certain than when made with vaseline, etc.; it is also less "mussy."

A dish, *A*, is partly filled with water. In it are placed a glass vessel for lime (or barium) water, *B*, supported on any solid support, *C*, to raise it above the water in *A*. A leaf (geranium) may be placed over *B* with the petiole extending into the water

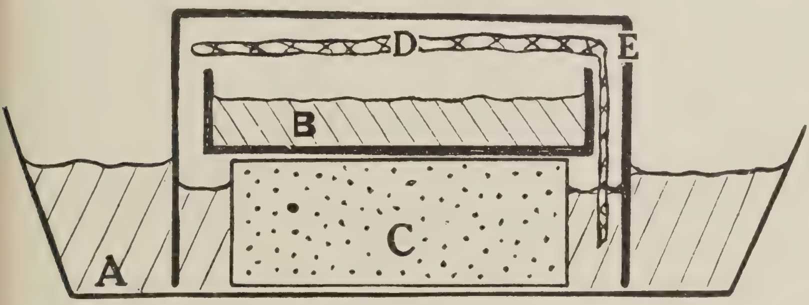

FIG. 1.—*A*, a dish or pan containing water for making an air-tight joint around *E*.
B, glass containing lime-water.
C, support.
D, a geranium leaf.
E, a glass dish enclosing *D* and *B*.

in *A*. (The petiole is, of course, not necessary, but students seem to feel that the conditions are more normal when the petiole has access to water in this way.) Over all is inverted a crystallizing dish, *E*, which should be but slightly wider in diameter than

B, making very little air enclosed in the space under E. An inverted vessel rarely sits firmly when inverted over water and a bent tube may be used to draw out some of the air under E. This will make E more steady, and will also make the water rise in E and lessen the air space. If too much air is drawn out, and the water around B rises too high, it will be difficult to remove E at the end of the experiment without the risk of causing an overflow into B and breaking the heavy film that forms on the surface of the lime water.

The control is exactly the same, except the leaf is omitted. The air space under E is so small that in the control but a partial, delicate film is formed on the lime water, contrasting strongly with the heavy one formed in 12 to 24 hours by one green leaf.

TEACHERS COLLEGE

NOTES ON RUTACEAE — VI. SPECIES OF SPATHELIA*

BY PERCY WILSON

The species of *Spathelia* L. are confined, in so far as known, to the West Indies, with a very doubtful species reported from Mexico.

Of the five recognized species of *Spathelia*, *S. simplex* and *S. glabrescens* are endemic in the island of Jamaica, while *S. cubensis* is known only from the province of Oriente, Cuba, and *S. Brittonii* from the province of Pinar del Rio. *S. vernicosa*, originally described from specimens collected in eastern Cuba, is also found on Cat Island, Bahamas.

They are slender unarmed trees one to twenty-four meters tall, with simple unbranched trunks conspicuously marked with leaf-scars, and bearing pinnate leaves, and large panicles with showy purplish or scarlet flowers at the summit. The ovary is usually 3-celled, and the fruit normally 3-winged.

It is apparent from observations made by several students of West Indian plants, that wherever species of *Spathelia* are found there are always present, in a dead or dying condition, a few speci-

* Notes on Rutaceae—V was published Bull. Torrey Club 38: 295–297. 6 Jl 1911.

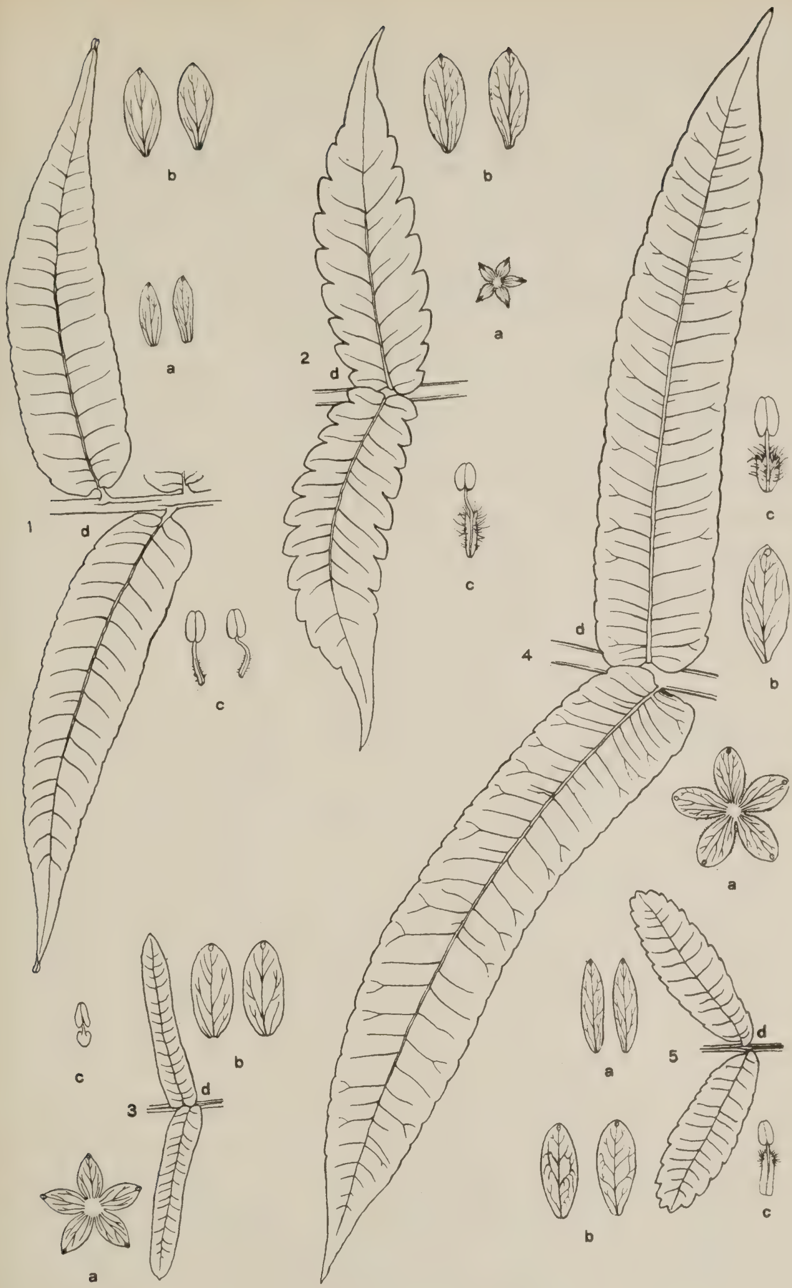

FIG. 1.

FIG. 1.—In each figure a = sepals (or calyx), $\times$ 2, b = petals, $\times$ 2, c = stamens, $\times$ 2, d = leaflets, $\times$ ½.

1. *Spathelia glabrescens* Planch.
2. *Spathelia Brittonii* P. Wilson.
3. *Spathelia cubensis* P. Wilson.
4. *Spathelia simplex* L.
5. *Spathelia vernicosa* Planch.

The figures have been made from drawings by Miss M. E. Eaton.

mens bearing old fruiting inflorescences, and in no instance do they appear to have been destroyed by disease or fire. Other observers who have had the opportunity to study them during their entire stage of reproduction, assert that the plants show signs of decay with the maturing of their fruits and soon afterward die. It would undoubtedly afford an interesting subject for investigation to ascertain the age the various species of *Spathelia* reach before producing their flowers and fruits. Definite information upon this subject appears to be lacking.

Descriptions of each of the foregoing species will be found in North American Flora **25**: 206–208. 1911.

New York Botanical Garden.

SHORTER NOTES

New Names in Ilex

Ilex kingiana n. n.; *Ilex insignis* Hook. f., Fl. Brit. Ind. *I*, 599 (1872); not *I. insignis* Heer, Fl. Foss. Alask. 37, pl. x (1869).

Ilex microphyllina n. n.; *Ilex microphylla* Newby. Proc. U. S. Nat. Mus. **5**: 510 (1883); not *I. microphylla* Hook. Ic. Pl. or Spreng. D. C. Prod. *2*: 12.

Salix fastwoodiae in the new edition of Heller's Catalogue, p. 89, is of course a misprint for *S. Eastwoodiae*, as its position in the list shows. It is *S. californica* Bebb. (not Lesq.).

T. D. A. Cockerell

REVIEWS

Alexander's Outline Key of Michigan Sunflowers*

The utter impossibility of fitting the sunflowers of southeastern Michigan into the specific limits of sunflowers as given in the manuals, has led Mr. Alexander, of Detroit, to undertake the study of these plants. As the result of six years of study, he has worked out a system of classification of the perennial sunflowers, based upon the underground parts of the plants. He recognizes two main groups which he calls the Storeatae, in which the roots and root-stocks are tangled together into a close

* Alexander, S. Outline Key of the Groups of the Genus *Helianthus* in Michigan. Report Mich. Acad. Science **13**: 191–198. *f. 1–5*. 1911.

mat; and the Sparsae, in which there is a shorter or longer underground root-stock (which he calls the "earth-branch"). In the first group, new plants arise from buds on this matted crown; the plants, therefore, all remain in a close cluster. In the other group, the new plants are scattered at some distance from the old plants. The Storeatae are again subdivided into those in which the roots become very fleshy and usually more or less spindle-shaped toward the end of the season. The contents of these roots are used up by the following year's growth. The other division consists of those with fine fibrous roots. Further subdivisions of these are based upon the fact that the leaves are three-nerved in some, and pinnate-nerved in others. Still further subdivisions are based upon the hairiness. The group Sparsae is divided into sections in which the underground stems are terminated by tubers (*H. tuberosus* being an example), and those not so enlarged. The latter are again divided into those with petiolate leaves and those with practically sessile leaf-blades. Further subdivisions are based upon the presence or absence of wings upon the petioles, and on the nervation of the leaf-blades.

The author finds that by subdividing the plants in this way, he can distinguish a large number of species which have apparently never been described. It is to be hoped that botanists elsewhere, where the perennial sunflowers are abundant, will try out Mr. Alexander's key as to its workability in other localities.

East Lansing, Michigan — Ernst A. Bessey

NEWS ITEMS

A hurricane accompanied by rain and snow on the night of November 11, at Lafayette, Ind., did much injury to the botanical department of the Purdue Experiment Station. The windows of the offices and laboratories were blown in, but the herbarium room escaped unharmed. About half of the glass in the conservatories was broken, and as the storm was followed by severe cold, practically all the plants perished. The collection included many species gathered from all parts of the country for culture hosts in the study of rusts.

Dr. D. T. MacDougal, director of the department of Botanical Research of the Carnegie Institution, has gone to Egypt to prosecute studies on the desert vegetation of that region. Dr. W. A. Cannon recently returned from a preliminary survey of the deserts in northeastern Africa, under the auspices of the same institution.

At the American Association for the Advancement of Science meeting at Washington, D. C., during Christmas week, Dr. C. E. Bessey, of the University of Nebraska, will act as president.

We quote from the New York *Evening Post* (December 2) the following, in regard to Columbia University:

"A greenhouse and botanical laboratory is now in course of construction in East Field, the half block between Amsterdam and Morningside Avenues, which was recently acquired by the university, and on which the President's house is being erected. The greenhouse stands in the middle of the block, just back of the President's house. It is to be used by professors and advance students in the Department of Botany.

"In the conservatory, which will be twenty-four by eighty feet, plants for use in all botanical work, both graduate and undergraduate, will be grown. Moreover, it will contain a laboratory and a dark room, equipped with all the modern appurtenances. . . . Advanced classes in plant physiology and experimental botany will work in the conservatory, as will the groups in experimental plant pathology."

From the New York *Evening Sun* (December 11) we learn that Sir Joseph Hooker has died. Joseph Dalton Hooker was a retired surgeon of the Royal Navy and late director of the Royal Gardens at Kew. He was born at Halesworth, Suffolk, June 30, 1817. He was educated at the High School and the University of Glasgow. He was surgeon and naturalist on his Majesty's ship Erebus in the Antarctic expedition under Sir James Ross in 1839–43. He visited as a naturalist the Himalaya Mountains, Syria and Palestine, Morocco and the Greater Atlas. He was in the Rocky Mountains and California in 1877. Sir Joseph was president of the Royal Society, 1872–77.

INDEX TO VOLUME XI

New names and the names of new genera and species are printed in **boldface type**

TORREYA

A Monthly Journal of Botanical Notes and News

JOHN TORREY, 1796–1873

EDITED FOR

THE TORREY BOTANICAL CLUB

BY

NORMAN TAYLOR

Volume XII

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ERRATA, VOLUME XII

Page 51, 4th line from top, read *officinale* for *officinalis.*

Page 228, 3d line from bottom, read *breeding* for *breedong.*

Page 256, 3d line from top, read *Blakeslee* for *Blakslee.*

Page 266, 9th line from bottom, read *Aconitum* for *Aconitium.*

Page 268, 7th line from top, capitalize *Hydrastis* and *Berberis.*

Page 276, 4th line from top, read *G. H. Shull* for *G. A. Shull.*

Page 276, 7th line from bottom, read *Roland Thaxter* for *R. B. Thaxter.*

Dates of Publication

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No. 5,	May	97–120	May	10, 1912
No. 6,	June	121–143	June	11, 1912
No. 7,	July	145–174	July	11, 1912
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No. 11,	November	257–276	November	10, 1912
No. 12,	December	277–316	December	13, 1912

TORREYA

January, 1912

Vol. 12 No. 1

LIST OF PLANTS COLLECTED ON THE PEARY ARCTIC EXPEDITION OF 1905–06 AND 1908–09 WITH A GENERAL DESCRIPTION OF THE FLORA OF NORTHERN GREENLAND AND ELLESMERE LAND

By P. A. Rydberg

(*Continued from December Torreya*)

II. List of Plants Collected by Dr. L. J. Wolf and by Dr. J. W. Goodsell

Ferns*

Dryopteris dilatata (Hoffm.) A. Gray (*Aspidium spinulosum dilatatum* Hook.). A rather common species of north temperate regions of America, Europe, and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 78*, *86*, and *88*.

Filix fragilis (L.) Underwood (*Cystopteris fragilis* Bernh.). A species distributed over most parts of the world in colder or mountainous regions.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 43*.

Monocotyledons

Alopecurus alpinus Smith. A grass of arctic swamps and meadows of North America, Europe, and Asia, also found in the northern Rocky Mountains and the mountains of Scotland.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 23;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 56*.

Calamagrostis canadensis L. A common grass of open woods,

* Determined by Mr. R. C. Benedict.

[No. 12, Vol. 11, of Torreya, comprising pp. 249–278, was issued 12 Ja 1912. The date, 20 D 1911, given in December Torreya, as the day of issue, is an error.]

thickets, and meadows from Labrador to North Carolina, California, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 64* and *66*.

Deschampsia flexuosa (L.) Trin. In dry places from southern Greenland to North Carolina, Tennessee, and Michigan; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 65* and *62* (the latter bears leaves only, but probably belongs here).

Poa alpina L. An alpine-arctic grass, distributed over arctic and subarctic North America and extending south to Quebec and Lake Superior and in the Rocky Mountains to Colorado; also in Europe and Asia.

Grant Land, July, 1906, *Wolf*. Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 9*.

Poa glauca Vahl. (*P. caesia* Smith). An arctic grass of circumpolar distribution; found also in the White Mountains of New Hampshire and some of the mountains of northern Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 63* and *87*.

Poa glauca elatior And. With the species but less common and apparently restricted to arctic North America.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 24*.

Poa abbreviata R. Br. A very rare, truly arctic species, distributed from the arctic coast of North America to Greenland and Spitzbergen.

Grant Land, July, 1906, *Wolf;* vicinity of Cape Sheridan, Grant Land, June 15–July 17, 1909, *Goodsell 57;* also a sterile tuft (not numbered) which probably belongs here.

Poa evagans Simmons. The specimens in the collection are doubtfully referred to this species, of which there are no specimens in the herbaria here in America. The only locality given by Simmons is on the southern coast of Ellesmere Land.

Grant Land, July, 1906, *Wolf*.

Festuca rubra L. Meadows from Greenland to North Carolina, California, and Alaska; also in Europe and Asia.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 40.*

Festuca supina Schkur (*F. ovina supina* Hackel). A fairly common dry-land species of arctic-alpine North America, Europe, and Asia, in this country extending south to Vermont, Colorado, and California.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 55.*

Festuca supina forma *vivipara.* The specimens in this collection have the glumes hirsutulous, at variance with the usual form of *F. supina.* They match perfectly specimens collected by Lundbom at Nunarsuak, Greenland.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 67* and *76.*

Eriophorum Scheuchzeri Hoppe. In swamps from Greenland to Newfoundland, Manitoba, Oregon, and Alaska; also in Europe.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 3;* ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 75.*

Carex canescens L.* Swamp from Newfoundland and Labrador to Virginia, Colorado, Oregon, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, *Goodsell 69.*

Carex brunnescens gracilior Britton.* Moist places from Labrador to New York, Colorado, and British America.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 68.*

Juncoides hyperboreum (R. Br.) Sheld. (*Luzula confusa* Lindebl.). A species of arctic America, Europe, and Asia; extending south in this country to the mountains of New England and the northern Rockies.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 22.*

Dicotyledons

Salix Waghornei Rydb. A rare willow, found in Newfoundland and Labrador.

* Determined by Mr. K. K. Mackenzie.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 73*. (Leaves only, but evidently belonging here.)

Salix glauca L. A species common in arctic and subarctic Europe. The specimens belong to the American form growing in Labrador and Newfoundland. It differs considerably from the European form, especially in pubecsence, and may be distinct.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 72*.

Salix arctica Pall. A dwarf arctic species of willow, common in Asia and western North America but rare in the northeastern part of the latter continent. Only a small sterile specimen was collected by Dr. Wolf, which seems to belong to this species.

Grant Land, July, 1906, *Wolf*.

Salix groenlandica (Anders.) Lundstr. A dwarf arctic willow confined to Greenland, Labrador, and the islands of Baffin Bay.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 5;* Grant Land, Latitude 82° 27′, July, 1906, *Wolf*.

Salix anglorum Cham. (*S. arctica* R. Br.; not Pall.; *S. arctica Brownei* Anders.). A dwarf arctic species, ranging from Greenland to Alaska.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 6* (depauperate); vicinity of Cape Saumarey, August, 1908, *Goodsell 26*.

Oxyria digyna (L.) Hill. The arctic sorrel is common in arctic and alpine regions of North America, Europe, and Asia, extending south in this country to New Hampshire, Colorado, and California.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 19;* vicinity of Cape Sheridan, Grant Land, July 15 to Aug. 17, 1909, *Goodsell;* Grant Land, July, 1906, *Wolf*.

Bistorta vivipara (L.) S. F. Gray (*Polygonum viviparum* L.). In cold swamps from Greenland to New Hampshire, Colorado, and Alaska; also in Europe and Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 20*.

Alsine Edwardsii (R. Br.) Rydb. (*Stellaria Edwardsii* R. Br.). An arctic species ranging from Greenland and Labrador to the Hudson Bay region, the Canadian Rockies, and Alaska.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 15;* vicinity

of Etah, Aug. 8–16, 1908, *Goodsell 37;* Grant Land, July, 1906, *Wolf.* In *Goodsell 15*, the calyx is more or less white-villous.

Cerastium alpinum L. An arctic-alpine species, the range of which extends from Greenland to Quebec, the Canadian Rockies, and Alaska; also in Europe and Asia.

Grant Land, July, 1906, *Wolf;* vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 8;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 13;* ravine on Caribou Island, Battle Harbor, Aug. 15, 1909, *Goodsell 79;* vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 54.* (The latter is a depauperate form answering to var. 3 of Simmon's Vascular Plants of Ellesmereland.)

Cerastium alpinum lanatum Lindebl. An arctic variety, confined to Greenland and neighboring islands.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 14.*

Wahlbergella apetala (L.) Fries (*Lychnis apetala* L.). An arctic-alpine species, distributed through the colder parts of Europe, Asia, and North America, in the latter extending south to Labrador and in the Rockies to Utah and Colorado.

Grant Land, July, 1906, *Wolf.*

Wahlbergella triflora (R. Br.) Fries (*Lynchnis triflora* R. Br.). An arctic species, apparently confined to Greenland.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 10;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 41* (poor and doubtful specimen).

Ranunculus nivalis L. An arctic-alpine species, distributed over parts of Europe, Asia, and North America, in the latter extending from Greenland and Labrador to the northern Rockies and Alaska.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 51.*

Papaver radicatum Rottb. (*P. nudicaule* Lange, not L.; *P. alpinum* Am. auth.; not L.). The so-called "Iceland poppy" is one of the most showy arctic species and in many places is the characteristic plant of the arctic flora. It is common in the whole arctic region of North America and Europe, less so in Asia, where *P. nudicaule* L., a related species, is more common.

P. radicatum extends south to Labrador and in the Rockies to Colorado.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 1;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 12;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 36;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 50;* Grant Land, July, 1906, *Wolf.*

Draba alpina L. A circumpolar arctic species, in America extending south to Labrador and the Canadian Rockies.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 2;* vicinity of Cape Sheridan, Grant Land, June 15–17, 1909, *Goodsell 53* (depauperate).

Draba glacialis Adams. An arctic-alpine species distributed over most of the northern part of Asia and North America, in the latter extending south in the Rockies to Wyoming.

Vicinity of Cape Sheridan, June 15–July 17, 1909, *Goodsell 52.*

A specimen with rather densely pubescent pods is doubtfully referred here. The typical *D. glacialis* has the pod glabrous or nearly so.

Grant Land, July, 1906, *Wolf.*

Draba fladnizensis Wulfen. An arctic-alpine plant, distributed through the arctic and subarctic regions and the higher mountains of Europe, Asia, and North America, extending as far south as the Pyrenees, Himalayas and the Rockies of Colorado.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 18;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 46.*

Draba hirta L. A circumpolar arctic species, also found in the mountains of Europe and Asia, but in America confined to the arctic regions.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 25.*

Braya glabella Richardson. A rare species confined to arctic America.

Grant Land, July, 1906, *Wolf.*

Cochlearia groenlandica L. A strictly arctic species, probably of circumpolar distribution.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 27.*

Cochlearia fenestrata R. Br. An arctic species, closely related to the last and often confused with it. It is apparently confined to arctic America.

Grant Land, July, 1906, *Wolf.*

Rhodiola rosea L. (*Sedum Rhodiola* DC.). A species not uncommon in the arctic and mountainous parts of Europe; in America confined to the north, extending south to Newfoundland and Maine in the east. It has also been collected at two stations in Pennsylvania.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 74.*

Saxifraga cernua L. A circumpolar arctic-alpine species, in America extending south to Labrador and in the Rocky Mountains to Colorado.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 16;* vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 60* (depauperate specimen); Grant Land, July, 1906, *Wolf.*

Saxifraga rivularis L. A circumboreal species, in America extending south to the White Mountains and to the Rocky Mountains in Montana.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 48.*

Muscaria caespitosa (L.) Haw. (*Saxifraga caespitosa* L.). A circumpolar arctic and subarctic species, extending in America from Greenland to Labrador, Montana, British Columbia, and Alaska.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 59.*

Leptacea tricuspidata (Rottb.) Haw. (*Saxifraga tricuspidata* Rottb.). An arctic-alpine species, ranging from Greenland to Labrador, Lake Superior, the Canadian Rockies, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 47* and *42;* vicinity of Cape Saumarey, Aug. 8, 1909, *Goodsell 28.*

Leptacea flagellaris (Willd.) Small (*Saxifraga flagellaris* Willd.). A circumboreal alpine-arctic species, extending in America south in the Rockies to Arizona.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 58;* Grant Land, July, 1906, *Wolf.*

Antiphylla oppositifolia (L.) Fourr. (*Saxifraga oppositifolia* L.). A circumpolar arctic-alpine species, in America extending south to Vermont, Montana and British Columbia.

Vicinity of Cape Sheridan, Grant Land, June 15 to July 17, 1909, *Goodsell 49;* vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 11;* Grant Land, July, 1906, *Wolf*.

Potentilla emarginata Pursh. An arctic species, ranging from Greenland and Labrador to the Canadian Rockies and Alaska; also in Siberia and on Spitzbergen.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 7;* vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 32*.

Potentilla Sommerfeltii Lehm. A rare arctic species, growing in Spitzbergen, Greenland, the Baffin Bay islands, and the arctic coast of America.

Grant Land, July, 1906, *Wolf*.

Potentilla pulchella R. Br. An arctic species of the same range as the preceding, but it has also been collected on Wrangel Island off Siberia.

Vicinity of Etah, Aug. 6–18, 1908; *Goodsell 39*.

Potentilla Vahliana Lehm. An arctic species, ranging from Greenland through the islands north of Hudson Bay, and the arctic coast of America to Alaska.

Vicinity of Cape Saumarey, Aug. 8, 1909, *Goodsell 31*.

Sibbaldiopsis tridentata (Soland.) Rydb. (*Potentilla tridentata* Soland.). A plant of rocky places, ranging from Greenland to the mountains of Georgia, west to Minnesota and Manitoba.

Ravine on Caribou Island, Battle Harbor, Aug. 15, 1909, *Goodsell 82*.

Comarum palustre L. A swamp plant distributed through northern and subalpine Europe, Asia, and America, ranging in the latter from Greenland to New England, Minnesota, Wyoming, California, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 77*.

Rubus Chamaemorus L. An arctic and subarctic bog plant, ranging from Labrador and Newfoundland to New Hampshire, British Columbia, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 91*. (The specimens are in leaf only.)

Dryas integrifolia Vahl. An arctic and subarctic species, distributed from Greenland to Anticosti and Alaska.

Vicinity of North Star Bay, Aug. 3–6, 1908, *Goodsell 4*. Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 21*.

Empetrum nigrum L. An arctic and subarctic undershrub of wet and rocky places from Greenland to Maine, northern New York, Michigan, Montana, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 70*.

Viola palustris L. In swamps from Labrador to New England, Colorado, Washington, and Alaska; also in Europe and Asia.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 83*.

Chamaenerion latifolium (L.) Sweet (*Epilobium latifolium* L.). An arctic-alpine plant of moist places, ranging from Greenland to Quebec, Colorado, Oregon, and Alaska; also in Europe and Asia.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 33*.

Epilobium palustre L. A circumpolar bog plant, extending in this country south to the White Mountains and Ontario.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 84*.

Cornella suecica (L.) Rydb. (*Cornus suecica* L.). A circumpolar arctic or subarctic plant of wet woods, ranging in this country from Labrador and Newfoundland to Quebec and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 85*.

Conioselinum pumilum Rose sp. nov.

Stems simple or nearly so, low, 12 to 15 cm. high, glabrous, purplish, somewhat fluted; stem leaves 2 or 3, small, 3 to 6 cm. long, ternately divided, ultimate segment sharply toothed or cleft, glabrous; inflorescence a small compact terminal umbel, sometimes with an additional lateral one; involucre none; involucel bractlets several, filiform, longer than the pedicels; rays 12 to 18 mm. long, only slightly if at all scabrous; pedicels 3 to

4 mm. long, glabrous; fruit smooth; carpels 3 to 3.5 mm. long, a little longer than broad; stylopodium depressed.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 81*.

Pyrola grandiflora Radius (*P. rotundifolia grandiflora* DC.). An arctic and subarctic bog plant, ranging from Greenland to Labrador and the Mackenzie River.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 45*.

Cassiope tetragona (L.) D. Don. An arctic species, distributed from Greenland and Labrador to Washington and Alaska; also in Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 30*.

Ledum groenlandicum Oeder (*L. latifolium* Ait.). A bog plant, ranging from Greenland to Massachusetts, New Jersey, Wisconsin, British Columbia, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 71*.

Vaccinium Vitis-idaea L. A circumpolar undershrub, common in Europe but rare in America, there ranging from Greenland to Massachusetts, Lake Superior, British Columbia, and Alaska.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 90*.

Campanula uniflora L. An arctic-alpine species, ranging from Greenland and Labrador to Alaska and in the Rockies south to Colorado; also in northern Europe and Asia.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 17*.

Solidago macrophylla Pursh (*Solidago thyrsoidea* E. Meyer). A plant of rocky woods from Labrador to the Catskill Mountains, Lake Superior, and Hudson Bay.

Ravine on Caribou Island, Battle Harbor, Labrador, Aug. 15, 1909, *Goodsell 80*.

Erigeron trifidus Hook. An arctic-alpine species, distributed from Greenland to Colorado, California, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 38*.

Arnica alpina (L.) Olin. An arctic and subarctic species, ranging from Greenland to Labrador, the Canadian Rockies, and Alaska.

Vicinity of Etah, Aug. 6–18, 1908, *Goodsell 34* and *44*.

Taraxacum phymatocarpum Vahl. An arctic species, confined to Greenland and Ellesmere Land.

Vicinity of Cape Saumarey, Aug. 8, 1908, *Goodsell 29;* vicinity of Etah, Aug. 6–18, 1908, *Goodsell 35*.

Taraxacum pumilum Dahlst. An arctic species, confined to the arctic American archipelago.

Grant Land, July, 1906, *L. J. Wolf*.

Taraxacum hyparcticum Dahlst. An arctic species, ranging from northwestern Greenland through the arctic archipelago, along the arctic coast to Point Barrow, Alaska.

Grant Land, July, 1906, *L. J. Wolf*.

NEW YORK BOTANICAL GARDEN

TWO SPECIES OF HABENARIA FROM CUBA

By OAKES AMES

Habenaria Brittonae *sp. nov.* In general habit similar to *H. alata* Hook. 6 dm. tall, slender. *Leaves* linear-oblong to linear-lanceolate passing gradually into the foliose acute bracts of the stem. *Raceme* 12 cm. long, slender, rather densely flowered, the bracts nearly equalling or exceeding the flowers. *Lateral sepals* 6.5 mm. long, lanceolate, acute, with the midnerve produced under the point into a setiform tip, margin obscurely denticulate. *Upper sepal* broadly ovate, 5 mm. long, otherwise similar to the lateral. *Petals* subsimple or obscurely bipartite. Posterior division linear-oblong, rounded at the tip, obtuse, 5 mm. long, about 1 mm. wide, recurved-falcate, anterior division in the form of an obtuse, basal protuberance or tooth. *Labellum* tripartite, lateral divisions shorter than the middle one, setaceous, about 3 mm. long, middle division linear, 6 mm. long, obtuse, convex, the margins strongly deflexed. *Stigmatic processes* longer than the anther canals, flattened suborbicular. *Spur* longer than the labellum, about equalling the ovary or shorter, clavate, subacute, about 1 cm. long.

Folia lineari oblonga, alterna, (?) 4–5. *Bracteae* caulis vaginantes super folia lineari-lanceolatae, acutae, infra folia obtusae. *Bracteae inflorescentiae* lanceolatae, acutae, ovaria longitudine excedentes. *Sepala lateralia* lanceolata, ad apicem cuspide munita. *Sepalum superius* ovatum, obtusum. *Petala* sub-

simplicia, falcata, linearia, obtusa, basi antice unidentata vel petalorum partitio antica in dentum minutum reducta. *Labellum* tripartitum, laciniae laterales lineares vel filiformes 3 mm. longae, lacinia media 6 mm. longa. *Calcar* ovario brevius 1 cm. longum.

Cuba: Province of Pinar del Rio, vicinity of Venales, on hillside, *N. L. & E. G. Britton*, no. 7540, September 17, 1910; Wright 3307 in Hb. Gray.

I have been unable to refer this plant satisfactorily to any described species of *Habenaria*. It is similar in habit to *H. repens* Nutt., but from that it differs markedly in the form of the petals and labellum. The cuspidate or mucronate sepals are similar to *H. repens*. It may be the form of *H. tricuspis* Rich. to which Grisebach referred in his *Catalogus Plantarum Cubensium* characterized by reduced anterior divisions of the petals, an assumption which leads to the belief that *H. tricuspis* may not be referable to the synonymy of *H. repens* after all, and that it is a variable plant, characterized by variations in the relative lengths of the lip divisions and by petals with variously reduced anterior segments. However this may be, I find in my herbarium a specimen of *H. repens* from Georgia accompanied by the following note: "Compared with Wright 3305 (sub nom. *tricuspis*) and Wright 3309 (sub nom. *tricuspis* Rich. near *H. radicans* Griseb.) at British Museum and found to be like them." The specimen in question is quite distinct from *H. Brittonae*. In the study of the type material of *H. tricuspis* Rich. the conclusions arrived at, as indicated in *Orchidaceae IV*, were that it was conspecific with *H. repens*, a conclusion which is borne out by Kränzlin in *Orchidacearum Genera et Species*, and by Cogniaux in Urban's *Symbolae Antillanae*, although neither author states that he has seen Richard's type.

Wright's 3305 and 3309 preserved in the Gray Herbarium of Harvard University, both labelled *H. tricuspis* var., are referable to *H. repens*, as they have the characteristic perianth divisions of that species. Wright's 3307, on the other hand, preserved in the same collection, is characterized by lips and petals similar to those of the plants from Venales. *H. tricuspis* as described by

Richard does not include *H. Brittonae*, which appears to be an undescribed species.

Habenaria nivea (Nutt.) Spreng.

This species, which heretofore has been known only as a native of the United States, with a range extending from Florida and Louisiana on the south to Delaware on the north, is now known to be a native of Cuba. I have examined five plants collected in Pinar del Rio Province, submitted for identification by the Director of the New York Botanical Garden. I have compared the flowers very carefully with those of *H. nivea* from Florida and other parts of the United States without being able to find distinguishing characters which indicate specific differences. There are differences, but they are slight and too trivial in my estimation to warrant the recognition of a new species.

CUBA: PINAR DEL RIO PROVINCE, Laguna Santa Maria, *N. L. & E. G. Britton, & C. S. Gager*, no. 7126, September 8, 1910. Wet sandy pine-lands, Sierra del Cabra, on Guane Road, *N. L. & E. G. Britton, & C. S. Gager*, no. 7272, September 9, 1910, on hillside.

AMES BOTANICAL LABORATORY,
NORTH EASTON, MASS.

UNDESCRIBED SPECIES OF CUBAN CACTI

BY N. L. BRITTON AND J. N. ROSE

Pereskia cubensis sp. nov.

A tree up to 4 meters high, with a trunk up to 2.5 dm. in diameter, and a large, much-branched-top; bark brownish, rather smooth, marked by black horizontal bands (representing the old areoles) broader than high. Young branches slender, smooth, with light brown bark; spines of young areoles 2 or 3, needle-like, 2–3 cm. long, of old areoles very numerous (25 or more) and much longer (5 cm. or more long); leaves bright green on both sides, somewhat fleshy, the midvein broad, distinct, the lateral veins very obscure, oblanceolate to oblong-elliptic, several at each areole, 1.5–4 cm. long, 10–12 mm. wide, acute at both ends; flowers small, white (?), solitary; peduncle very short (2–3 mm. long), fleshy, jointed near the base, bearing 1 to 3 leaf-like bracts; fruit not seen.

Dry thickets at 5–10 meters elevation, province of Oriente.

Specimens examined: *C. Wright 205* (*type*); Los Caños, March, 1909 (*N. L. Britton 2013*); near Caimanera (*Eggers 5441*).

Illustration: Jour. N. Y. Bot. Gard. **10**: 109. *f. 22.* 1909.

Wright's plant was distributed as *P. portulacifolia* and so recorded by Grisebach, but that species of Hispaniola has quite different leaves, as is shown by the old illustration of *Cactus portulacifolius* L. is based (Plumier, ed. Burmann, *pl. 197. f. 1*) and by specimens collected by Buch in Haiti, examined by Professor Urban.

A similar, perhaps identical, species grows on La Vigia Hill, Trinidad, Province of Santa Clara (*Britton & Wilson 5513*).

Opuntia cubensis sp. nov.

Plants about 6 dm. high, rather widely branched. Joints oblong, dull green, 8–18 cm. long, 7 cm. wide or less, 1–2 cm. thick, not readily detached, their margins slightly crenate; areoles 1–2 cm. apart; spines 2–5 at each areole, acicular, pale yellow when young, becoming grayish-white, the longer 5 cm. long or less; glochides numerous, brown, 3–4 mm. long; ovary clavate, 4 cm. long, bearing several tufts of glochides; corolla pale yellow, 8 cm. broad.

In sand, valley near coast, U. S. Naval Station, Guantanamo Bay, March, 1909, *N. L. Britton 2064.*

A species of the Series Tunae, related to *O. Dillenii* and *O. lucayana*, both of which have brighter yellow spines and strongly crenate joints.

3. **Cephalocereus Brooksianus** sp. nov.

Plant 3–6 meters high, stout, much branched at base, dark bluish-green, densely pruinose. Ribs 8 to 9 deep, obtuse; areoles closely set, in flowering specimens almost contiguous, and bearing long hairs, very dense in flowering specimens; spines about 16, yellow, all somewhat similar, the upper one of each areole ascending; flowers about 5 cm. long, purplish; ovary naked.

Near Novaliches, about six miles south of Guantanamo, May 8, 1907 (*Wm. R. Maxon 4512*).

Named in honor of Mr. Theodore Brooks, of Guantanamo, who has greatly facilitated the botanical exploration of eastern Cuba.

Leptocereus Leoni sp. nov.

Plant up to 5 m. high, repeatedly branching, the round trunk 3 dm. in diameter at the base, the cortex scaly-roughened, the old areoles 1–1.5 cm. apart in vertical rows and bearing acicular spines. Ultimate branches about 1.5 cm. thick, slender, elongated, 6–8-ribbed, the ribs crenate, the areoles borne at the depressions, 1–1.5 cm. apart; spines 6–12 at each areole, yellowish when young, gray when old, slenderly acicular, 2–9 cm. long; wool brown, very short; perianth pink, withering-persistent, narrowly campanulate, 3.5 cm. long; the limb about one fourth as long as the tube, which bears numerous scattered areoles, each with 1–4 short spines or some of them spineless; segments of the limb about 15, oblong-orbicular, obtuse; stamens very numerous; stigma not exserted; fruit globose-oval, 2 cm. in diameter, with a few scattered spine-bearing areoles; seeds black.

Limestone cliffs, Sierra de Anafe, near Guayabal, extreme eastern part of the province of Pinar del Rio (*Brother Leon*, Nov. 9, 1911, *2819, type; 2802; Britton, Cowell & Leon 9594*).

Leptocereus arboreus sp nov.

Plant up to 5 meters high, erect, much branched. Joints 3–10 dm. long, 4–6 cm. wide, narrowed at base; ribs 4, narrow, thin, 1.5–2 cm. deep, somewhat depressed between the areoles; areoles 2.5–4 cm. or less apart; spines 10 or fewer, acicular, yellowish, becoming gray, radiating, the longer up to 5 cm. long; corolla short-campanulate, about 2 cm. long, almost enclosed in the bur-like ovary; petals cream-colored; fruit ellipsoid, 8–10 cm. long, 5–6 cm. thick, its areoles bearing tufts of numerous light yellow spines.

Rocky hillside, Punta Sabanilla, mouth of Cienfuegos Bay, Province of Santa Clara, February 24, 1910 (*Bri ton, Earle & Wilson 4573, type*); Castillo de Jagua, Cienfuegos Bay (*Britton, Cowell & Earle 10298*).

Coryphantha cubensis sp. nov.

Plants depressed-globose, tufted, 2–3 cm. broad, pale green. Tubercles numerous, vertically compressed, 6–7 mm. long, 4–5 mm. wide, about 3 mm. thick, grooved on the upper side from the apex to below the middle, the groove very distinct; spines about 10, whitish, radiating, acicular but weak, 3–6 mm. long, those of young mamillae subtended by a tuft of silvery white

hairs 1.5 mm. long; flowers pale green, 16 mm. high, the segments acute.

Among small stones in barren savanna southeast of Holguin, Oriente (*J. A. Shafer 2946*).

Cactus Harlowii sp. nov.

Plants light green, 2.5 dm. high or less, simple or sometimes in clusters of 3 to 6 on the tops of old individuals. Ribs 12, rather narrow; areoles becoming glabrate, closely set (less than 1 cm. apart); radial spines about 12, slender, slightly spreading, 10 to 20 mm. long, reddish, becoming straw-colored in age; central spines 4, similar to the radials, stouter and longer, sometimes 3 cm. long, often somewhat curved; cephalium prominent, composed of white wool and fine reddish brown bristles projecting beyond the wool; flowers small, 2 cm. long, deep rose red; fruit deep red, obovoid, short, 2 cm. long; seeds black, shining.

Coastal cliffs, U. S. Naval Station, southern Oriente, March, 1909. *N. L. Britton 1965*.

Named in honor of Captain Charles Henry Harlow, U.S.N., commandant at the Naval Station at the time this interesting species was collected.

CURRENT LITERATURE

A New Paint-destroying Fungus is the title of an interesting paper by Mr. George Massee, in the *Bulletin of Miscellaneous Information of the Royal Botanic Gardens at Kew, England*, No. 8, p. 325. In this place Mr. Massee describes a new species (*Phoma pigmentivora* Mass.) which is very destructive to white paint when present in greenhouses having a high humidity and temperature. We know that certain fungi grow upon media as diverse and apparently unsuitable as dilute mineral acids, writing ink, tannic acid solutions, etc., but they do not often fruit under such conditions. However, this fungus not only grows upon the paint, but seems to flourish and even produces its fruit in abundance. At first thought it seems somewhat startling that a plant should thrive upon a medium like paint containing large amounts of lead, which is usually one of the most toxic of agents acting upon organisms. This is another example of the great

flexibility and adaptability of living protoplasm to conditions apparently unfavorable in the highest degree.

About one month after the paint has been applied it begins to be dotted with small pink specks that increase in size, and finally turn purple. These blood-stain like blotches grow until they are several inches in diameter, and, of course, by this time have completely ruined the appearance of the painted structures. The spores are now produced in dark red, warty, fruiting bodies and are then liable to infect any other paint in the vicinity. Several greenhouse painters in England complain of serious losses through this agency.

When the spores of the fungus are sown on wet white paint they germinate readily and in a few weeks produce all the characteristic effects observed in the infected greenhouses. Upon pure linseed oil the spores germinate and grow for a time, but no fruit or pigment is produced. Furthermore, upon pure white lead there was no germination at all; so, both the oil and white lead seem to be necessary for the full development of the plant. The bright red pigment is produced in oily red drops inside a colorless cell wall. The nature of this pigment is unknown, but the author's suggestion that it may be due to the formation of the red oxide of lead hardly seems tenable, judging from his description of it or from the fact that it is bleached by hydrogen peroxide. Finally it was found that paint made up to contain two per cent. of carbolic acid was wholly free from infection with the organism. Here we see lead playing the part of a favorable medium for the growth of this fungus and carbolic acid acting as a fungicide.—E. D. C.

In discussing the origin of species in nature Dr. Henry Huss (*American Naturalist* for November) says: "Whoever can devote a part of his time to the study of a genus is able to establish the existence of differences, which, formerly ignored and in themselves slight, are of the greatest importance for the tracing of relationships."

Differences between the leaves of old and young shoots, variations shown by leaves of fruiting branches and adventitious

shoots, the common heterophylly in the horseradish, sassafras, and the mulberries all show that plants must be studied throughout their various stages of development and through the seasons.

Variation in garden plants (in leaf, in flower color, shape, and arrangement) are common and are probably more important than they are usually considered. From similar variations reported from widely distributed points or at widely separated intervals the conclusion is drawn that a new form, which has appeared at various times and which because of the nature of the variation is incapacitated from reproducing itself by seed, would from this very fact constitute an ideal illustration of repeated mutation, since a hybrid origin of the individuals which appeared later, is excluded.—J. B.

There has long been the impression that desert plants must have very deeply penetrating root systems, quite oblivious of the fact that in most desert regions the soil water lies so far below the surface that many if not the majority of plants would be quite unable to develop roots capable of reaching it. Dr. Cannon* in a recent paper has shown that there is a great diversity in the root distribution of such forms. Those which grow in the flood plains of the rivers, as for instance the mesquite, may indeed have fairly deep roots, for the water table in such localities is within reach even in a desert. Those, on the other hand, which grow on the detrital slopes are much more likely to have shallow root systems which extend over a large area. In even the larger cacti, for instance, the tap-root is a negligible quantity except perhaps for anchorage and the superficial laterals spread out for a long distance. The water which the plants avail themselves of is the surface moisture which comes from the seasonal though brief and scanty rains of the region. In Tucson, Arizona, where there are two short rainy seasons, one in winter, the other in summer, the annuals show a difference in the development of their absorbing systems which is apparently due to the relative difference of air and soil temperatures at those

* W. A. Cannon, Root Habits of Desert Plants. Carnegie Institution of Washington. Publication 131, pages 1–96, Pl. 1–23; fig. in text 1–17, Mar. 28, 1911.

periods, rather than being due alone to the difference in the mean air temperature. It is impossible in so short a notice to bring to the attention of the reader all the many points of interest in this publication which merits a careful perusal.—H. M. R.

Professor Peirce in the October *Popular Science Monthly* discusses the relation of civilization and vegetation. Civilization, he says, in "the form of agriculture plays sad havoc with natural native vegetation, destroying, driving back, exterminating most, domesticating and assimilating few, plants." Incidentally, in referring to the disappearance of the wild races from which our domesticated forms have arisen as due to assimilation he asks, "What is the joy of living as a tame hen, as a domesticated cow, as a pruned pear tree? 'The ox that treadest out corn' is sure of daily food; so is 'the cock of the walk'; so also are the subjugated plants of farm and garden; but individuality has been sacrificed for safety."

The article also discusses the injury to plants from air and soil gases, smoke, and cement rust.—J. B.

The Monardas: A Phytochemical Study by Miss Wakeman appeared as Part 4 of Volume 4 of the Science Series of the *Bulletin* of the University of Wisconsin. Now and then one has the pleasure of reading a publication of this type in which the problem of the relations of a group of morphologically similar plants are attacked with chemical tools and it is found that the chemical relationships are also close. The genus *Monarda* contains several representatives and all are found in North America. Many of the species have bright colors and agreeable aromatic odors, so were early used by the first settlers and probably also by the Indians as "medicine" in the treatment of disease. The species are widely distributed and they go under a number of different local names.

The red pigment of the brilliant *M. coccinea* (*didyma*) was studied as early as 1832. Later, other chemists examined the

volatile oils of different *Monardas* and found crystalline deposits in the oils after standing. Careful work upon authentic material was not done until begun under the direction of Professor Kremers at Madison. Numerous investigations have been made there, especially upon the essential oils of this group. The oils of *Monarda citriodora*, *M. didyma*, *M. fistulosa* and *M. punctata* were studied in detail. With the exception of *M. didyma* the oils all contained considerable amounts of aromatic phenols. Hydrocarbons like limonene were also present in several species. As a rule, all of the oils were light in color when freshly distilled but gradually turned darker in the course of time, probably owing to oxidation. This led the investigators to look for easily oxidizable substances and their search was successful, for they found that thymoquinone and certain of its derivatives were present in the oils. Now, the quinones, as a class, are often colored or yield brightly colored red, orange, or yellow substances after chemical treatment. We have here a group of closely related plants that contain substances of similar structure from the chemical point of view. A study of the part these substances play in the pigmentation of the plant was then undertaken.

The pigments of the different *Monardas* give to their flowers the red, yellow, brown and purple colors that make them attractive. These pigments are extracted with various solvents. The colors of each are different, but upon chemical study they all appear to be derived from one or two closely related mother-substances, among which thymoquinone has been obtained in the form of beautiful yellow crystals. Substances of this type give brilliantly colored final or intermediate oxidation products. It was found that the *Monardas* contain oxidases or oxidizing ferments (destroyed by heat) that can oxidize these color-producers from one stage to another with accompanying change of hue. Many investigators consider that numerous other cases of pigment formation in plants are due to the action of these oxidases upon various colorless constituents of the plant. The question of pigment production is one of growing interest among both botanists and chemists. The present publication is a valuable contribution to our understanding of this problem.

Miss Wheldale, in England, has recently published two papers that are very interesting in the same connection. One is "The Chemical Differentiation of Species," *Biochemical Journal* **5**: 445 (1911); and the other is "The Colours and Pigments of Flowers with Special Reference to Genetics," *Proceedings of the Royal Society*, Series B, **81**: 44 (1909).—E. D. C.

Under the authorship of M. F. Barrett of the State Normal School at Upper Montclair, New Jersey, there has appeared a "LEAF KEY TO THE GENERA OF THE COMMON WILD AND CULTIVATED DECIDUOUS TREES OF NEW JERSEY." The author apparently realized the impossibility of determining the different genera of trees by leaf characters alone, and frequent use is made of other but equally obvious characters. Used under the guidance of a teacher knowing the trees, the key should prove a useful pamphlet to the beginner. Some of the distinctions drawn between genera, the hickories and walnuts for example, require more botanical judgment than the unaided beginner is apt to have, but the key will be a great help in class work, where the instructor exercises considerable interpretative helpfulness. Copies may be procured from the above address and cost only ten cents each. —N. T.

The September *Mycologia* includes an article by Bruce Fink on the nature and classification of lichens; it consists chiefly of collected statements of various botanists with reference to considering lichens as a distinct class. About 83 per cent. of the 115 botanists consulted believe that the lichens should be maintained as a distinct group of plants; the balance would distribute them among other fungi to the exclusion of the group Lichenes. Forty botanists favored maintaining LICHENES, considering it a natural group. Europeans are more favorable to this division than Americans. Convenience for study is evidently considered an additional argument for maintaining the group.—J. B.

We are pleased to mention Publication No. 1 of the Botanical Society of Western Pennsylvania, issued Nov. 27, 1911. It has

been projected for the publication of articles, not too deep and extended, upon the flora of the western part of the state. Besides the proceedings of the Club and reports of the administrative character, it contains papers on the Pteridophytes of Allegheny County, The Fungal Flora of Pittsburgh, and Rambles in Panama and Jamaica. It has all of the characteristics of a well-edited and interesting journal covering a local area.—N. T.

A review (*Plant World*, July, 1911) of Fitting's recent paper dealing with the relation of osmotic pressure of the cell sap in plants to arid habitats gives some interesting figures concerning the pressure found in leaf cells. The reviewer, E. B. Livingston, says that "we find that the highest pressure developed by those desert forms is more than *thirteen* times what we have hitherto considered as *usual*. They are perhaps three times as great as the pressure observed in grass stems by Pfeffer. Hereafter the highest pressures observed by ordinary green plants must be cited as at least over 100, perhaps as high as 130 atmospheres, or even higher."—J. B.

PROCEEDINGS OF THE CLUB

October 25, 1911

The meeting of October 25, 1911, was held in the Museum Building of the New York Botanical Garden at 3:30 P.M., Vice-President Barnhart presiding. Fifteen persons were present.

The scientific program consisted of informal reports on the summer's work. Dr. N. L. Britton discussed the genus *Cameraria* L. and illustrated his remarks by specimens and illustrations of the known species, together with those of an undescribed one found by him at the United States Naval Station, Guantanamo, Cuba. He also remarked on the large number of undescribed species of plants in many genera contained in the recent Cuban collections of the New York Botanical Garden.

Dr. Marshall A. Howe gave a brief résumé of a paper on "Some

Marine Algae of Lower California, Mexico," which had been accepted for publication in the November number of the *Bulletin*. The algae of Lower California have been hitherto almost unknown, only seven species having been attributed to the region. The materials on which the present paper was based give evidence of the existence there of at least thirty-four species, a good proportion of them being new to science, and it seems probable that adequate exploration of the region would show its algal flora to be rich and varied.

Dr. J. K. Small gave some brief notes on certain species of *Peperomia*, and Dr. H. M. Richards outlined some research work on acidity in cacti, which he had been prosecuting at the Desert Laboratory, Tucson, Arizona.

Meeting adjourned.

FRED J. SEAVER,
Secretary pro tem.

NOVEMBER 14, 1911

The meeting of November 14, 1911, was held at the American Museum of Natural History at 8:15 P.M., Vice-President Barnhart presiding. Forty-five persons were present.

The minutes of the meetings of October 10 and October 25 were read and approved.

Mrs. N. C. Nuris, 611 W. 177th St., New York City, and Dr. George F. Bovard, University of Southern California, Los Angeles, California, were proposed for membership. There being no further business to consider Mrs. N. C. Nuris was then elected to membership in the Club.

The announced scientific program of the evening consisted of a lecture on "Trees of New York City," by Professor C. C. Curtis. The lecture was illustrated by numerous lantern slides.

Meeting adjourned.

B. O. DODGE,
Secretary

NEWS ITEMS

Professor J. E. Kirkwood has issued a prospectus of the short course in Forestry (January to March) at the University

of Montana. A score of courses are offered, many of them of a strictly botanical nature. The course is free and information thereto may be obtained from Professor Kirkwood, at Missoula, Montana.

Dr. Eng. Warming, director of the Botanic Museum and Garden, and Professor of Botany at the University of Copenhagen, resigned from his office December 31, 1911. His successor is Professor C. Raunkiaer.

At Cornell University Mr. M. Ishikama has been appointed an assistant in botany.

We learn from *Nature* (December 21) that Dr. D. T. MacDougal lectured before the Royal Geographical Society on December 18, on the North American Deserts.

Mr. Percy Wilson, of the New York Botanical Garden, has returned from Cuba, where he has been continuing the explorations of that institution in Pinar del Rio.

At a meeting of the board of estimate and apportionment of New York City on Thursday, January 18, contract was let for the construction of the first sections of the laboratory building and plant houses of the Brooklyn Botanic Garden.

At the Washington meeting, held during Christmas week, Prof. L. R. Jones was elected president of the Botanical Society of America, and Prof. D. S. Johnson, vice-president of Section G, A. A. A. S.

The following were elected officers of the Torrey Club at the annual meeting held at the American Museum of Natural History on Tuesday, January 9: *President*, E. S. Burgess; *Vice Presidents*, J. H. Barnhart and H. M. Richards; *Secretary and Treasurer*, B. O. Dodge; *Editor-in-Chief*, P. Dowell, with the following acting on the board of editors: J. H. Barnhart, Jean Broadhurst, E. D. Clark, A. W. Evans, R. A. Harper, M. A. Howe, H. M. Richards, and N. Taylor. Dr. Mansfield was elected delegate to the Council of the New York Academy of Sciences.

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WINTER-KILLING AND SMELTER-INJURY IN THE FORESTS OF MONTANA*

By George Grant Hedgcock

The great Washoe smelter at Anaconda, Montana, among the largest in the world, throws off annually, in spite of certain precautions taken to prevent it, a great volume of sulfur oxides and arsenic. There is little doubt, in view of the experiments made with sulfur dioxid, most of which have been made by European investigators, that this form of sulfur even when very dilutely diffused in air is injurious to plants. The fumes of arsenic take on a solid condition in open air and are probably not injurious to the foliage of forest trees. The effect of the accumulation of sulfuric acid and arsenic in the soil on the roots of plants is still somewhat uncertain, especially in small quantities. An excess, especially of the former, must undoubtedly interfere with the natural processes of decomposition and soil fertilization. The latter in large quantities can hardly fail to be poisonous.

During the winter of 1908–9 in some portions of the Northwest, more especially in Montana, many forest trees suffered from a peculiar form of injury which was apparently due to weather conditions the probable cause of which will be discussed in another paper. This injury was most severe in the following national forests: Absaroka, Beartooth, Bitterroot, Blackfeet, Deerlodge, Gallatin, Madison, and Jefferson. The injury was frequently quite severe. During the past three years, in all, about 40,000 acres of coniferous trees have died from its effects in Montana.

This form of winter injury has received the name locally of

* Published by permission of the Secretary of Agriculture.

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the "Red Belt" owing to the red appearance of the injured conifers, especially of the pines *en masse*, and the occurrence in most instances of the injured portion of the forest in narrow bands or strips of land, situated on the slopes of hills or mountains and running parallel to their bases, or to the valley floor below. The injury, judging from a consensus of observations by a number of observers, must have occurred in January, 1909, but was first noticed some time after it occurred, when the leaves began to redden and dry out. This injury took place at a time when the injury by smelter fumes in the region around Anaconda was a matter both of considerable discussion and litigation. This region reached by fumes from the Washoe smelter will be called the Smelter Zone in this paper. The matter of injury to the conifers in the Deerlodge National Forest became a matter of controversy, and the question naturally arose as to whether any of the "Red Belt" type of winter injury had occurred in the Smelter Zone.

The writer has spent a considerable portion of the past two summers making a study of the injury to trees by smelter fumes as compared with that of the winter of 1908–9 in order to separate the two forms of injury by differences apparent to the eye in the forest. It is found that while there are fine color distinctions in the two forms of injury that are easy to detect, when it comes to describing them in words, it is difficult to find terms to express these color distinctions exactly; on the other hand it is much easier to describe both their initial and final effects upon growth and behavior of the trees affected.

Smelter fumes and winter injury both redden the needles of pines in the more acute forms of each, but the smelter injury causes a brighter color and does not so often kill the whole leaf as in case of winter injury. In case of lodgepole pine and of Douglas fir trees, the Red Belt winter injury in the acute form killed not only the leaves but often the terminal buds and twigs, and the whole tree died the season following the injury. In the acute form of smelter or SO_2 injury the leaves die more gradually, and the terminal buds especially of the top shoots are the last to die. The death of such trees takes place slowly, from a more or less gradual defoliation often extending through several years;

and not from the effect of a direct and immediate injury, which killed the leaves by drying them out in a short space of time, completely defoliating and killingthe trees, as in the Red Belt.

The Red Belt injury occurred while there was a deep snow in most of the forests affected, and the younger parts of small pines and firs were injured only above the snow, the older parts covered with snow remaining green and healthy. On the other hand young trees suffering from acute smelter injury die in a reverse order, the lower limbs, and the older leaves dying first, the upper limbs and younger leaves last, the snow affording no protection in summer.

The less acute form of injury by smelter fumes usually known as chronic injury, causes a much slower defoliation of coniferous trees than the acute form. In lodgepole pines and firs, the leaves gradually lose their bright green color and become chlorotic, usually with a reddish tinge. All gradations between this appearance in typical chronic injury and the brightly reddened needles the acute form are found. In both forms the older needles are killed first, but in the chronic form, death takes place more slowly than in the acute.

In the less acute forms of Red Belt injury few terminal buds or twigs were hurt and only the leaves were affected. The leaves were reddened where the tips were killed, and in many instances the trees were nearly defoliated by the death of the needles in 1909. New green leaves, however, were put forth from the terminal buds of the less severely injured trees; some of these were chlorotic in appearance. Slightly injured trees lost only a portion of the foliage and recovered their growth at once.

A third form of smelter injury has been inaptly named invisible injury in Germany. This consists in a gradual and premature defoliation of the trees accompanied by a slight chlorosis and change of appearance in the leaves. This form checks the growth of the trees, and often at a later date assumes chronic form.

In all the forms of smelter injury in the smelter zone about Anaconda the general effect has been to form decreased annual wood rings year by year as the defoliation becomes more complete, until the width of a ring is often so slight that a powerful

lens is necessary to measure its diameter. In such extreme cases little or no autumn wood is produced in the rings. This tapering in growth in the wood rings is most pronounced in acute smelter injury, and the date of the first injury is often graphically shown by the first lessened annual ring, especially in young conifers.

On the other hand, coniferous trees injured in the Red Belt regions, entirely out of the Smelter Zone, do not as a rule show a gradual decrease in the annual increment for the past 5 to 10 years, as is shown by trees in the regions of acute and chronic injury in the Smelter Zone. In the most acute Red Belt injury, trees died suddenly after years of rapid and steady growth; in less acute forms where the trees recovered, there was little or no growth in 1909, followed by increasing growth or increment in the wood for 1910 and 1911.

The forested area in which the trees were killed by Red Belt injury was small when compared to the total area of the forests affected.

In Deerlodge National Forest, in the Smelter Zone, no greater percentage of the forest has suffered from Red Belt injury than has occurred in adjacent forests, in fact, according to the data collected by the writer, there is less of this injury.

The amount of damage in the same area in the Deerlodge National Forest due to wood-rotting fungi is no more than that in adjacent forests. Old and mature Douglas firs and pines are diseased occasionally with heart rots caused by *Polyporus Schweinitzii* and *Trametes pini*. On the other hand certain rusts, as *Peridermium elatinum*, *P. coloradense*, and species of *Phragmidium*, *Melampsora*, and *Roestelia* are almost entirely absent from the Smelter Zone around Anaconda, although often present in abundance in adjacent forests beyond this zone.

A great difference in the ability of conifers to withstand the effects of smelter fumes has been noted. The species in the Smelter Zone named in order of susceptibility to injury are as follows:

1. *Abies lasiocarpa* (Hook.) Nutt. (Alpine fir).
2. *Pseudotsuga taxifolia* (Lam.) Britt. (Douglas fir).
3. *Pinus contorta* Loud. (lodgepole pine).

4. *Picea Engelmanni* (Parry) Eng. (Engelmann's spruce).
5. *Pinus ponderosa* Laws. (western yellow pine).
6. *Pinus flexilis* James (limber pine).
7. *Juniperus scopulorum* Sarg. (Rocky Mountain juniper).
8. *Juniperus communis* L. (dwarf juniper).

The last three named species are quite resistant and in Deerlodge National Forest in the Smelter Zone show little or essentially no injury from smelter fumes.

The ability of trees to withstand the Red Belt form of injury is not in the same ratio as that of their resistance to smelter fumes. In order of the susceptibility to winter injury the species above named are as follows:

1. *Pinus ponderosa.*
2. *Pseudotsuga taxifolia.*
3. *Pinus contorta.*
4. *Pinus flexilis.*
5. *Picea Engelmanni.*
6. *Abies lasiocarpa.*
7. *Juniperus scopulorum.*
8. *Juniperus communis.*

All species showed some injury in the Red Belt winter injury of 1908–9. *Pinus flexilis*, *Juniperus scopulorum*, and *J. communis* exhibited, so plainly, forms of injury that the health of these species in the portions of the Smelter Zone where they are found is taken as proof that no winter injury has occurred in these regions during recent years.

The leaves of aspens (*Populus tremuloides* Michx.), alders (*Alnus tenuifolia* Nutt.), and of willows (*Salix* spp.) exhibit peculiar forms of leaf scorch, blackened, reddened, or discolored areas of parenchyma which are not found on leaves of the same species in other regions, in adjacent forests subjected to the Red Belt winter injury, but not to smelter fumes.

In much of the inner portion of the Smelter Zone adjacent to the smelter, few or no seed are borne by conifers, and little or no reproduction is taking place. The seedlings, apparently, are killed as soon as they appear above the ground. Not so in areas outside of the Smelter Zone, where only winter injury has

occurred. In such localities, reproduction is gradually beginning to take place.

In no other portion of Montana do we have a zone of injury comparable to that surrounding the Washoe smelter at Anaconda, where radiating from a central point, the injury decreases gradually outward in every direction from a common center. In this region where variation in the bands of injury occur, they can be shown to be due to the tendency of the clouds of smoke in damp weather either to settle in the valleys or to follow the easiest channels of surface configuration, here thrown against a slope, and there deflected away by striking a protected slope or valley.

Acknowledgment should be made to Messrs. W. B. Greeley, assistant forester, and F. A. Silcox, district forester of District No. 1 of the Forest Service, for their courtesy in securing data on the time of occurrence of the Red Belt injury of 1908–9, its scope, and extent; and to Messrs. J. F. Preston, D. T. Conkling, D. T. Mason, R. P. McLaughlin, C. W. Hudson, forest supervisors, and others of the forest service who contributed the data just mentioned.

Office of Investigations in Forest Pathology,
Bureau of Plant Industry,
Washington, D. C.

THE GENUS HAMELIA JACQ.

By N. L. Britton

Mr. H. F. Wernham has recently contributed to the Journal of Botany* a very useful account of *Hamelia*, a genus of Rubiaceae, comprising, according to his studies, twenty-eight species, all American, ranging from Florida and Mexico to Paraguay.

Of the twenty-eight species recognized, the following are described as new:

H. magniloba. Nicaragua.

H. grandiflora Spruce. Chimborazo.

* Jour. Bot. **49**: 206–216. Jl 1911. A supplementary note, loc. cit. 346. N 1911.

H. magnifolia. Costa Rica.

H. ovata. Venezuela.

H. Rovirosae. Tabasco; Guatemala.

H. pedicellata. Colombia; Venezuela; Trinidad; Dominica; St. Vincent.

H. tubiflora. Colombia.

H. viridifolia. Costa Rica.

H. brachystemon. New Grenada.

H. Brittoniana. Costa Rica.

Hamelia axillaris Sw. of Jamaica, reduced by Grisebach to *H. lutea* Rohr, is maintained as a species, on the evidence of the specimens collected long ago by Swartz and by W. Wright, preserved in the herbarium of the British Museum, but this does not appear to be conclusive, and *axillaris* is the older name. For this species Mr. Wernham cites also *Tonduz 9998* in the Kew Herbarium, but this is from Costa Rica not Jamaica.

H. pedicellata Wernham does not appear to be certainly distinct from *H. erecta* Jacq. (*H. patens* Jacq. a posterior name) from which it is separated by its scanty pubescence and "mostly" pedicelled flowers; but some of the flowers of *H. erecta* are often pedicelled, and as Mr. Wernham remarks, the pubescence of *erecta* is a very variable quantity.

To the genus may be added:

Hamelia scabrida sp. nov.

A small tree, 4 m. high. Leaves opposite, or those of small twigs whorled in 3's, broadly ovate, rather firm in texture, the blade 10 cm. long or less, short-acuminate at the apex, rounded or narrowed at the base, scabrate with numerous scattered short conic papillae on the upper surface, pubescent and with some similar papillae on the veins beneath; veins about 7 on each side of the midrib, widely ascending; petioles 2 cm. long or less; stipules triangular, subulate-tipped; flowers sessile or short-pedicelled, secund on the branches of terminal forking cymes; calyx campanulate, glabrous, 3–4 mm. long, its teeth triangular, abruptly subulate-tipped, 1–1.5 mm. long; corolla yellow, narrowly funnelform, 3–4 cm. long, its lobes 3 mm. long, obtuse; stamens and style very nearly as long as the corolla; berry oblong, 10–14 mm. long, 8–9 mm. in diameter; seeds 1 mm. long, shining, distinctly minutely tuberculate.

Rocky thicket, Fairfield, Parish of Manchester, Jamaica, September 3–7, 1909 (*Britton 3147*).

In Mr. Wernham's arrangement this comes next to *H. ventricosa* Sw., and is, in fact, nearest related to that species, which has different foliage, larger corolla and much smaller seeds.

The leaves of *H. scabrida* are quite as papillose as those of *H. papillosa* Urban of the Jamaica Cockpit Country, which has very much smaller flowers and globose fruits over 1 cm. in diameter.

FOSSIL FLOWERS AND FRUITS.—II

By T. D. A. Cockerell

The genus *Robinia* was formerly distributed over the Palaearctic region, as shown by a number of well-preserved fossils in the European Tertiary. A species (*R. arvernensis* Laurent) flourished in south-central France as late as the "Mio-pliocene." Probably the genus died out in Europe during the glacial period. At the present time conditions are well suited to *R. pseudacacia*, which has run wild extensively. In America, we have a species (*R. Brittoni* Ckll.) from the Florissant Miocene but it might have been supposed that the genus was really of Old World origin, and came over to America in Miocene times. Such an idea seems to be negatived by the discovery of pods of an apparently genuine *Robinia* in the Laramie Cretaceous.

Robinia mesozoica n. sp.

Pods of the same size and general appearance as those of the modern *R. pseudacacia* L.; base moderately tapering; apex with a short oblique point but otherwise rather obtuse; breadth of a large pod 14 mm., of a smaller but apparently mature one 10; wing-margin very distinct, nearly 3 mm. broad in the larger pod; seeds placed almost transversely, the obliquity very slight, as in the modern *R. pseudacacia*. Neither pod shows the whole length.

Collected by Mr. N. E. Hinds in sandstone, south side of a yellow cliff a few miles north of Whitelv Peak, which is about

25 miles north of Kremmling, Colorado; Aug. 27, 1911. The formation was at first supposed to be Mesa Verde, but there seems to be no doubt that it is Laramie. A leaf of "*Platanus*" *Raynoldsii* Newberry is on the same piece of rock, one side touching the pods. The specific name chosen may be considered to

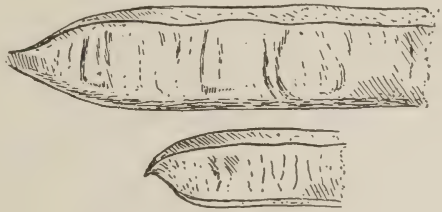

FIG. 1. *Robinia mesozoica.*

refer to the fact that the plant comes from the late Mesozoic, and also to its occurrence in that middle period of time, between the typical Mesozoic and the dawn of the Tertiary, represented by the Laramie and other formations.

A similar pod, possibly also a *Robinia*, has been described by Knowlton from the Yellowstone as *Acacia lamarensis*. The chief difference is that in the Laramie plant the seeds are placed very obliquely in the pod.

Leucaena coloradensis Cockerell

A very good pod of this species, containing a number of seeds, was found by Mr. Geo. N. Rohwer at station 17 in the Miocene shales of Florissant. The seeds are obliquely placed, exactly as in the living *L. Greggii* Watson, and are about 6 mm. long and 4.33 broad; their apices are about 2 mm. distant from the opposite margin of the pod.

BOULDER, COLORADO.

SHORTER NOTES

NEW NAMES FOR GAMOPETALOUS PLANTS.—In order to show correct relationship with accepted genera the following nomenclatorial changes are proposed.

Amarella Hartwegi (Benth.) n. comb.; *Gentiana Hartwegi* Benth. Pl. Hartw. 47. 1840.

Amarella mexicana (Griseb.) n. comb.; *Gentiana mexicana* Griseb. Gen. Sp. Gent. 243. 1839.

Cirsium Flodmanii (Rydb.) n. comb.; *Carduus Flodmanii* Rydb. Mem. N. Y. Bot. Gard. **1**: 451. 1900.

J. C. ARTHUR

REVIEWS

Dinsmore's Plants of Palestine*

Mr. Dinsmore's paper is practically a checklist of the plants now definitely known to occur in Palestine. From this list are omitted the various species and some genera heretofore credited to Palestine in Post's Flora of Syria, Palestine and Sinai and in the older Flora Orientalis by Boissier, now believed to be extralimital, or included in other species under older names. A careful census of the first half of the list and of scattered genera through the remainder show that Mr. Dinsmore's checklist includes a few score species not credited to Palestine in the mentioned earlier floras. This number proves rather smaller than might be expected from a region where continuous exploration and collecting have given opportunities far beyond those available to the earlier writers.

The arrangement, or classification, is that of DeCandolle, in the main, and follows almost *seriatim* the arrangement given in Post's Flora. The Latin names of families, genera and species are accompanied by proper abbreviations for the respective authorities, but there are no further references to the places of publication and occasionally a species is named after some authority where only close study of synonymy would show it to be not applicable to the original authority for the same name; in some cases referring to the same species, in others referring to different species.

The species in Mr. Dinsmore's list are numbered and are accompanied by five arbitrary signs which indicate the uses or

* Dinsmore, J. E.—Die Pflanzen Palästinas. Auf Grund eigener Sammlung und der Flora Posts und Boissiers, mit Beigabe der arabischen Namen von Prof. D. Dr. G. Dalman, pp. 1–122. J. C. Hinrichs'sche Buchhandlung, Leipzig, 1911.

cultivation, or distribution of the various species for the general regions indicated in Palestine.

This list seems to have its chief value in its accompaniment of arabic names for such species as are identifiable and for those species concerning which there is little doubt in the application of native names. These arabic names are distinguished so far as authoritative use is concerned by initials after those who have made special study or who have already published such arabic equivalents. The noticeable feature of these arabic equivalents is the large number of them whose application to species botanically known is the authoritative work of Professor Dalman. Were it not for these additional arabic terms, which must be of great reference value to any one understanding the arabic language and having occasion to deal in any way with Palestine plants, it would seem that the time and money invested in this list had been unwisely expended, for the classification is now far out of date and in no wise departs sufficiently from DeCandolle and Post to be of individual value. It is to be regretted that the pamphlet was not written with the classification of Engler's Syllabus which represents the most widely accepted classification in present-day use.

It should be borne in mind that Mr. Dinsmore was limited to conditions in the city of Jerusalem, under which it is exceedingly difficult to do the highest grade of scientific work, due to the almost entire absence of library facilities and on account of the long distance to extensive collections where thorough and adequate comparison of material could be made.

It is quite probable, too, that Mr. Dinsmore had no opportunity to study Decaisne's Florula Sinaica, Ann. Soc. Nat. Paris, 1836; Lowne's Flora of Sinai, Jour. Linn. Soc., 1865; Tristram's Fauna and Flora of Palestine, Palestine Exploration Fund, London, 1884; the manuscript catalog of the Flora of Palestine, by Hanbury and J. Hooker (at Kew); or Hart's Some Account of the Fauna and Flora of Sinai, Petra and Wâdy' Arabak, Palestine Exploration Fund, London, 1891.

The author of the list has introduced a few forms under already recorded species, which forms appear by the character of pub-

lication to be new, but if they have not been previously published in some other journal, they must be relegated to the already regrettably extensive list of *nomina nuda*. This unfortunate condition would not have obtained had Dinsmore appended a few terms of characterization by which the new forms could be distinguished from the species to which they are related.

The general summary is, then, that Dinsmore's Die Pflanzen Palästinas is a *seriatim* list of the plants of Palestine quoted from Post's Flora of Syria, Palestine and Egypt limited to those known to Mr. Dinsmore to occur in Palestine; accompanied by the already published arabic equivalents on the authority of Boissier, Bauer, Hadded, etc., with the addition of other arabic equivalents on the authority of Dalman; prepared without reference to the entire reclassification of plants which has been so actively carried out during the last twenty-five years, a reclassification almost universally adopted in botanic centers and in educational institutions.

E. L. Morris

CURRENT LITERATURE

In 1904 K. M. Wiegand and F. W. Foxworthy issued a key to the genera of woody plants in winter. This valuable little pamphlet of 33 pages has run through several editions and was perhaps the best known treatment of the subject until the present time. From the Storrs Experiment Station we have just received a much more elaborate work* covering a similar field.

After a preface acknowledging the chief sources of information and a short bibliography, the authors take up in the introduction, first, the question of "Names." Throughout they have given the commoner vernacular names of each species as well as the ". . . one scientific name at present sanctioned by botanical authorities." Naturally these are the names maintained in the new Gray Manual, and the authors are to be congratulated upon

* Blakeslee, A. F., and Jarvis, C. D. New England Trees in Winter. Bull. Storrs Agr. Exp. Sta. **69**: 307–576. [Je] 1911. Storrs, Conn. [Received in December, 1911.]

the adoption of this admirable system, which enforces a minimum of botanical orientation upon the user. However unscientific it may be to place the white pine under *Pinus* (instead of *Strobus*) and the choke cherry under *Prunus* (instead of *Padus*), it is nevertheless true that for the vast majority of the students who will use the work in hand, generic and specific segregates do not aid, but usually obstruct, the path of those who look in the old familiar genera for their commoner tree friends.

The introduction also includes such items as habit, twigs, leaf-scars, buds, fruit, etc. Each of these, and several other aids in the determination of trees in their winter condition, are discussed in detail, always from the viewpoint of the general reader and lumberman. A general key to the genera and individual keys to each genus complete the introductory matter. It may be found that the keys will require more familiarity with such things than the average user of the work will have, but they are excellent and have been drawn with admirable fidelity.

The body of the work contains a detailed description of habit, bark, twigs, leaf-scars, buds, fruits and wood, together with a discussion of the distribution and a comparison with other trees with which the one in hand might be confused.

Nearly all the native trees are treated thus, and a number of introduced species that are practically wild, or so widely cultivated that they attract as much attention as native species. For each species there is a splendid composite photograph showing general habit, character of bark and of the branches and twigs. Frequently, also, the fruits and nuts are shown. There is a comprehensive index and a glossary of botanical terms, which in the text have been avoided wherever consistent with accuracy.

After the large crop of the "How to Know" books, and numberless compilations, great and small, the jaded tree-lover will turn with avidity to this excellent study of the trees in winter. For reasonableness of nomenclature and practicality of taxonomic treatment, for a certain thoroughness and freshness of handling, the work is immeasurably in advance of any recent publication upon the subject. Some discussion of the altitudinal preferences of the different species would have been welcome, but such a

small lack in a work so generally excellent is not to be taken seriously.*—N. T.

Dr. W. J. Gies, consulting chemist of the New York Botanical Garden and professor of biological chemistry in Columbia University, has been very active in the establishment of the *Biochemical Bulletin*, the first number of which appeared recently. This publication, which is to appear quarterly, each volume containing about five hundred pages, is the official organ of the Columbia University Biochemical Association. In addition to the publication of biochemical research, this organ aims to extend general biochemical knowledge and furnish a means of keeping the workers in the home laboratories in closer touch with those who have gone out to other fields of labor. The first number contains 160 pages and is devoted to scientific papers and notes and news of a biochemical nature. One of the papers (pp. 7–41, with three plates) is by Professor F. E. Lloyd, and is entitled, "The tannin-colloid complexes in the fruit of the persimmon, *Diospyros*." We understand that the *Biochemical Bulletin* will aim to give special encouragement to the development of chemical studies in botany and that chemical papers on botanical subjects will be welcomed to its pages.—From the *Journal of the New York Botanical Garden.*

H. D. Tiemann in *American Forestry* for April calls attention to the fact that wood workers know too little of the structure of wood. To the engineer, carpenter, and manufacturer the microscopic structure of this material ought to be most illuminating. It would answer such questions as the following: "Why is white oak more lasting and better wearing than red oak, and why is the former suitable for light cooperage while the latter is not? Why are firs so difficult to treat with preservatives and pines so easy? Why is eucalyptus so difficult to dry?"—J. B.

The Flora of the Raritan Formation. (Edward W. Berry. Geological Survey of New Jersey, Bulletin No. 3. 8vo, pp. 1–233,

* The work is being republished by the authors in book form. The original issue of the bulletin was free, but is now practically exhausted.

pls. 1–29+f. 1–5. Trenton, 1911.)—This contribution to Cretaceous paleobotany is largely a compilation of previous work by the author and those who preceded him in the investigation of the Raritan flora, although descriptions and figures of a few new species are included in it. About 100 of the 128 plate figures of fossil plants are reproductions of figures in Newberry's Flora of the Amboy Clays, the type specimens of which are in the museum of the New York Botanical Garden where, the author gracefully states, "they are well arranged and easily accessible." Numerous incidental references may also be found to other type and figured specimens in the museum, collected by Dr. Arthur Hollick in Long Island, Block Island and Martha's Vineyard.

Although it adds but little that is new to science, as a handy reference work to the flora of the Raritan formation in New Jersey it is useful, especially as many necessary corrections in nomenclature have been brought down to date. Unfortunately, however, the work is seriously marred by innumerable typographic errors and other lapses due, apparently, to careless editing.—Arthur Hollick.

Mechanism favorable to insect pollination in cruciferous flowers is discussed in *Nature* (September 21) under a criticism of a recent German book by Günthart. Crucifers generally show (1) petal claws which "bend away from the lateral stamens as if to leave definite 'entrance slits' to the assumed nectar-containing pouches of the lateral sepals"; (2) the anthers of the longer stamens are commonly twisted on their filaments so as to face round toward the adjacent lateral ones, as if with the intention of rubbing the entering proboscis of an insect; (3) the edges of the filaments are frequently extended into elaborate appendage growths which are apparently intended to guide the proboscis of the insect visitor to the secreting surface.—J. B.

Mendelism. (Professor R. C. Punnett of the University of Cambridge. Published by The Macmillan Company, New York. 12mo, price by mail $1.38.)—The third edition of Punnett's treatise on Mendelism has recently appeared. This volume gives

a concise exposition of the original Mendelian doctrine together with the various modifications which have developed from recent investigations in genetics. The conceptions of the Cambridge school of genetics, especially in reference to the Presence and Absence Hypothesis, are well presented.

The general non-technical treatment, the clear statement of principles, the careful presentation of experimental data drawn from investigations with both plants and animals, and the use of excellent diagrams and illustrations combine to make the book of unusual interest to the general public.

It is to be regretted that, in spite of criticisms on the former editions, the author continues to define ovules and pollen grains as gametes. The development of the male and female gametophytes in flowering plants with the subsequent act of fertilization is thus presented: ' The pollen cell bores its way down the pistil to reach an ovule." In even a popular discussion of principles depending on definite factors which gametes bear, it is difficult to understand why the sex generation should be so lightly disposed of.

A few words upon this phase would give this interesting popular treatise an additional accuracy that is in keeping with well-known morphological facts.—A. B. Stout.

The Plums of New York. (Hedrick, U. P. Eighteenth Annual Report of the Department of Agriculture. State of New York, Vol. 3, Part II, or Report of the New York Agricultural Experiment Station for the Year 1910, II, pages viii+616. Albany, 1911.)—In the writing of this bulky volume, Hedrick has been assisted by R. Wellington, O. M. Taylor, W. H. Alderman and M. J. Dorsey. The Plums of New York is the third monograph of the fruits of New York State, the two preceding reports being on apples and grapes respectively. Broadly speaking, the work, which is illustrated by 108 beautifully colored plates of plums, is a horticultural and not a botanical work and yet it is of greatest value to the botanist. The book has been written for New York, but its contents are so general in character that it applies to the whole country and more or less to the world.

The first chapter is an historical account and a botanical classification of plums; the second a discussion of the present status of plum-growing in America; while the third and fourth are devoted to varieties of plums. The first and last two of these chapters contain the synonymy and bibliography of the species and varieties of plums. In the footnotes running through the book are given biographical sketches of plum growers.—JOHN W. HARSHBERGER.

In a recent text book of Egyptian agriculture edited by G. P. Foaden and F. Fletcher attention is called to the fact that the important staple crops are remarkably free from fungous diseases. Berseem and maize, although grown in enormous quantities, are practically free from disease; wheat only bears rust-pustules, commonly after the flowering period; and although cotton is inhabited by four common fungi, it is attacked by them at such times as to be but little affected by them. This is at least partly due to the climatic conditions: high temperatures unfavorable to fungi, and the unvarying character of the climate. —J. B.

An exceedingly attractive series of leaflets is issued from the Arnold Arboretum under the title of *Bulletin of Popular Information*. Number 11 of the series contains a discussion of the English elm, or rather, of the English elms, for there are two that ". . . grow naturally and spontaneously in Great Britain, *Ulmus glabra* and *Ulmus nitens*." Besides these two, there are two other species in northern and central Europe, *U. laevis* and *U. foliacea*, all in cultivation at the arboretum.

"When we speak [broadly] of *Ulmus campestris* we do not refer to any of these trees . . . , but to the so-called elm of the roadsides, avenues, and hedgerows of southern England. The origin of this tree is obscure. Growing spontaneously it is known only in England; it never ripens seed and it increases by suckers which are produced in profusion. Some authors have thought that it might be a hybrid; by others it has been suggested that it was brought from Italy to Britain by the Romans. . . . The oldest name of th's tree is *Ulmus surculosa*."

The statement is made that most of the seedlings imported from Europe as *U. campestris* are *U. foliacea*, and this has led to the confusion in this country in the identity of the English and European elms.

The *Bulletins* are published at frequent intervals during the growing season and are free.—N. T.

Volume 1, No. 1, of the Brooklyn Botanic Garden *Record* has just been issued. It is a quarterly, and according to its foreword, " . . . is purely an administrative organ, and is not intended either as a scientific publication or as a newspaper, but, as its name indicates, to serve as a record of the development and progress of the Garden, and as a medium of communication between the Garden and its constituency. One of the numbers of each volume will contain the Annual Report of the Director of the Garden."—N. T.

PROCEEDINGS OF THE CLUB

November 29, 1911

The meeting was held in the laboratory of the New York Botanical Garden and was called to order at 3:40 p.m. by the acting secretary in the absence of other officers. Ten persons were present. The reading of minutes and the transaction of business were passed over and the meeting proceeded with the scientific program. The first announced paper was by Mr. Arlow Burdette Stout on "The Characteristics of the Fungus *Sclerotium rhizodes* with special Reference to its Action on the Cells of its Host," of which the following is an abstract:

Mr. A. B. Stout presented in part the results of his investigations of the fungus *Sclerotium rhizodes* Auersw., a complete report of which will soon appear in a research bulletin of the Wisconsin Agricultural Experimental Station.*

Special mention was made of the behavior of the fungus in

* A more complete abstract than is here given appeared in Phytopathology, 1: 69.

the different organs of the host plant and microscopical preparations were exhibited demonstrating the relations of the fungus to the cells of its principal host *Calamagrostis canadensis*.

The fungus is coexistent in leaves, buds, stems, rhizomes and roots of the infected plants. Filaments of the fungus also form a thin weft on the exterior of the roots and extend out into the soil.

In the leaves the fungus is vigorously parasitic. In the culms fungal filaments are most abundant in the region of the nodes, but there is almost no destruction of tissues. In the underground parts of the culms and in rhizomes the hyphae completely digest the cell contents of cortical cells, but have no effect on the cell walls except at the points of actual penetration. In the older portions of roots the hyphae are scattered through the cortex, where they occupy empty cells. In the younger lateral roots the filaments of the fungus are found penetrating living cells and exhibiting characteristics which have been ascribed to mycorhizal fungi. Ultimately, however, the cell contents disappear while the fungus remains intact.

The fungus is perennial in the soil, and in the underground portions of the host. It is present in buds, but is unable to penetrate into the growing apex.

The fungus, therefore, exhibits a varying degree of parasitism in the different parts of the host.

The presentation of the second announced paper, "Studies on the Growth and Reproduction of Certain Species of *Ascobolus*," by Mr. Bernard O. Dodge, was omitted on account of the illness and absence of Mr. Dodge.

Mrs. N. L. Britton exhibited drawings and microscopic preparations illustrating certain types of thickening in the cell walls of the leaves of mosses.

Dr. N. L. Britton discussed the characters of a new species of *Elaeagia* from Cuba. This is a Rubiaceous shrub 8 or 10 feet high, with fruit imperfectly known. The hitherto known species of the genus *Elaeagia* occur in the Andes of South America and this new plant from the mountains of Cuba forms another link in the chain of relationship between the flora of the higher alti-

tudes of the West Indies and that of the mountains of South America.

After discussion of the various papers, adjournment followed.

MARSHALL A. HOWE,
Secretary pro tem.

NEWS ITEMS

We learn from *Science* that Mr. J. C. Th. Uphof, of Amsterdam, author of "Die Pflanzengattungen," has been appointed gardener for the Botanical Garden at the Michigan Agricultural College. He will also do work in connection with the herbarium. He is expected to enter upon his duties in the latter part of February.

Dr. Jean Baptiste Edouard Bornet, well known for his morphological and taxonomic writings on the algae, died at his home in Paris on December 18, 1911, aged 83 years. He was associated with Gustave Thuret in the publication of the classical "Notes Algologiques" and "Études Phycologiques" which did much to lay the foundations of an accurate knowledge of the structure and modes of reproduction of the marine algae. Figures from the detailed and beautifully artistic plates of these works have been familiar to students of the standard botanical textbooks for the past thirty years.

At the University of Pennsylvania Mr. F. W. Pennell has been granted a fellowship in botany and Mr. J. Y. Pennypacker a botanical scholarship.

Dr. C. B. Robinson, for several years connected with the Philippine Bureau of Sience, has returned to New York. His address, for the present, will be the New York Botanical Garden, where he will continue his studies on the flora of the Philippines, and on the family VACCINIACEAE.

TORREYA

March, 1912

Vol. 12 No. 3

PRIZE ESSAY ON THE LOCAL FLORA

A series of prizes is to be offered by a member of the Torrey Club for the best popular article on some feature of the vegetation of our local flora range.*

The prizes will be as follows:

1. A first prize of $25.00.

2. A second prize of $15.00.

3. For the five next best articles, a year's subscription to TORREYA. (Offered by the Club.)

The donor has delegated to the editorial board of the Club the arrangement and judging of the competition. With his consent they announce the following rules:

1. The competition is open to all amateurs, school teachers and others not on the staff of a botanic garden, college, or university.

2. Mere taxonomic revisions of genera or families will be excluded, but the essay may take any other feature of the local flora as its subject.

3. Articles should not be more than 4,000 nor less than 2,000 words long, and may or may not be accompanied by photographs, the expenses being of publication being borne by the Club.

4. The essays awarded first and second prizes will be printed in TORREYA. No manuscripts will be returned and the editors reserve the right to use any competing manuscript, as they see fit.

In submitting essays it should be borne in mind that the

* The local flora range as prescribed by the Club's Preliminary Catalogue of 1888 is as follows: All of the state of Connecticut; Long Island; in New York the counties bordering the Hudson River up to and including Columbia and Greene, also Sullivan and Delaware counties; all of New Jersey; and Pike, Wayne, Monroe, Lackawanna, Luzerne, Northampton, Lehigh, Carbon, Bucks, Berks, Schuylkill, Montgomery, Philadelphia, Delaware and Chester counties in Pennsylvania.

[No. 2, Vol. 12, of TORREYA, comprising pp. 25–44, was issued 15 F 1912.]

editors will consider, besides the botanical value of the articles, their literary worth, timeliness, also the care and accuracy used in their preparation. Specimens should be available, on request, for verification of names cited in the articles. It is desirable, but not obligatory that all manuscripts be typewritten, but this will have no effect on the judges' decision. They must, however, be written on one side of the sheet only.

Note: No manuscript will be considered to which the author's true name is affixed. All articles must be signed by some pseudonym, and a key to the latter sent in with the article in a separate sealed envelope, marked on the outside "Key to......," etc. After deciding as to the relative merits of the various articles the judges will open the envelopes containing the identifications of the pseudonyms.

All manuscripts must be mailed so as to be in on or before October 1, 1912. They should be sent to the editor of TORREYA,

NORMAN TAYLOR

CENTRAL MUSEUM,
EASTERN PARKWAY,
BROOKLYN, N. Y.

KEY TO THE WILD HERBS FLOWERING IN THE SPRING *

BY CHESTER ARTHUR DARLING

1 *a*. Flowers distinctly yellow, not at all red nor merely with a yellow center . . 2.
b. Flowers not yellow . . . . 72.
2 *a*. Flowers irregular, one petal modified into a swollen sac 1 in. or more long; leaves several, ovate, with entire margin.
Yellow Moccasin-flower. (*Cypripedium hirsutum.*)
b. Flowers not completely as in *a* . . . . 3.
3 *a*. Leaves in 1 or 2 whorls on an upright stem; flowers $\frac{1}{2}$–1 in. broad, curving beneath the upper leaves; styles conspicuous.
Indian Cucumber-root. (*Medeola virginiana.*)
b. Plants not completely as in *a* . . . . 4.

* This key is designed as an easy means of determining, in the field, the wild herbs to be found about New York City during the spring months or until June. In using the key it is always desirable to read both *a* and *b* before choosing between them; accuracy in observation and in following the key is of first importance. Additional copies may be had for 10 cents by addressing the author at Columbia University, New York City.

4 *a*. Leaves grass-like; perianth 6-parted, greenish outside.
Star-grass. (*Hypoxis hirsuta.*)
b. Leaves not grass-like .... 5.
5 *a*. Flowers small, usually without stalks, arranged in more or less compact heads .... 6.
b. Flowers not completely as in *a* .... 22.
6 *a*. Leaves compound with 3 leaflets .... 7.
b. Leaves not with 3 leaflets; heads of flowers subtended by an involucre of green bracts .... 10.
7 *a*. Stipules toothed at the base; seeds black when ripe.
Blackseed Hop Clover. (*Medicago lupulina.*)
b. Stipules not toothed at the base .... 8.
8 *a*. Terminal leaflet distinctly stalked.
Low Hop Clover. (*Trifolium procumbens.*)
b. Terminal leaflet not distinctly stalked .... 9.
9 *a*. Leaflets $\frac{1}{4}$–$\frac{1}{2}$ in. long; heads loosely flowered.
Loose-flowered Hop Clover. (*Trifolium dubium.*)
b. Leaflets $\frac{1}{2}$–1 in. long; heads densely flowered.
Hop Clover. (*Trifolium aureum.*)
10 *a*. Leaves all basal, deeply lobed; flowering stalk hollow; plant exudes a milky juice when broken .... **Dandelion.** (*Taraxacum Taraxacum.*)
b. Plants not completely as in *a* .... 11.
11 *a*. Stem very hairy; leaves bract-like, the large basal leaves wanting at flowering time .... **Colt's-foot.** (*Tussilago Farfara.*)
b. Plants not completely as in *a* .... 12.
12 *a*. Plants white-woolly throughout; leaves entire.
Cudweed. (*Gifola germanica.*)
b. Plants not completely as in *a* .... 13.
13 *a*. When open all flowers in the head with irregular, strap-shaped corolla, as in the Dandelion .... 14.
b. Only outer flowers in the head with an irregular, strap-shaped corolla, the inner ones tubular, as in the Daisy .... 17.
14 *a*. Flowering stalk with 1 head .... 15.
b. Flowering stalk with 2 or more heads .... 16.
15 *a*. Basal leaves entire; head 1–2 in. broad... **Hawkweed.** (*Hieracium pilosella.*)
b. Basal leaves usually toothed or lobed; heads $\frac{1}{4}$–$\frac{3}{4}$ in. broad.
Dwarf Dandelion. (*Adopogon carolinianum.*)
16 *a*. Basal leaves with purplish veins; stem leaves not clasping.
Rattlesnake-weed. (*Hieracium venosum.*)
b. Basal leaves not with purplish veins; stem leaves clasping.
Cynthia. (*Adopogon virginicum.*)
17 *a*. Heads 2–4 in. broad; plant covered with long hairs throughout; leaves usually entire .... **Yellow Daisy.** (*Rudbeckia hirta.*)
b. Plants not completely as in *a* .... 18.
18 *a*. Outer flowers with a brown or purple base; leaves pinnately divided.
Garden Tickseed. (*Coreopsis tinctoria.*)
b. Plants not completely as in *a* .... 19.
19 *a*. Outer flowers with corolla 3–7-lobed at the apex; lower leaves oblong or linear .... **Lance-leaved Tickseed.** (*Coreopsis lanceolata.*)

b. Plants not completely as in *a*......................................20.

20 *a*. Basal leaves round-ovate, heart-shaped at base.
Golden Ragwort. (*Senecio aureus.*)

b. Basal leaves tapering at the base into a winged petiole.................21.

21 *a*. Basal leaves obovate or oblanceolate, rounded at the apex.
Squaw-weed. (*Senecio obovatus.*)

b. Basal leaves usually oblong, rarely oblanceolate, not noticeably rounded at apex...................**Balsam Groundsel.** (*Senecio Balsamitae.*)

22 *a*. Flowers irregular..23.

b. Flowers regular..29.

23 *a*. Leaves compound; leaflets 6–10, with tendrils.
Vetchling. (*Lathyrus ochroleucus.*)

b. Leaves not completely as in *a*..................................24.

24 *a*. Flowers in a terminal spike or raceme...........................25.

b. Flowers solitary on axillary stalks..............................27.

25 *a*. Leaves entire.....................**Chaff-seed.** (*Schwalbea americana.*)

b. Leaves lobed or compound...26.

26 *a*. Leaves pinnately parted or lobed...**Wood Betony.** (*Pedicularis canadensis.*)

b. Leaves doubly compound, the leaflets linear.
Corydalis. (*Capnoides flavulum.*)

27 *a*. Leaves opposite, linear-lanceolate to ovate.
Cow-wheat. (*Melampyrum lineare.*)

b. Leaves alternate, broadly ovate to heart-shaped....................28.

28 *a*. Plants hairy; stipules ovate.....**Hairy Yellow Violet.** (*Viola pubescens.*)

b. Plants not hairy; stipules lanceolate.
Smooth Yellow Violet. (*Viola scabriuscula.*)

29 *a*. Plant without green leaves or green stem.
Squawroot. (*Conopholis americana.*)

b. Plants with green stem and green leaves.............................30.

30 *a*. Plants growing floating in water...................................31.

b. Plants not growing in water..32.

31 *a*. Leaves rounded, 3 in. or more broad; flowers solitary on the stalk.
Yellow Pond Lily. (*Nymphaea advena.*)

b. Leaves ovate, 5 in. or more long; flowers numerous on a spike.
Golden Club. (*Orontium aquaticum.*)

32 *a*. Perianth 6-parted, not differentiated into green calyx and colored corolla; stamens 6; leaves entire..33.

b. Plants not completely as in *a*....................................36.

33 *a*. Flowers solitary on the flowering stalk; leaves usually mottled.
Yellow Adder's-tongue. (*Erythronium americanum.*)

b. Plants not completely as in *a*....................................34.

34 *a*. Leaves basal; flowers in umbels...**Yellow Clintonia.** (*Clintonia borealis.*)

b. Leaves not basal; flowers solitary or 2 together......................35.

35 *a*. Leaves with the bases surrounding the stem.
Perfoliate Bellwort. (*Uvularia perfoliata.*)

b. Leaves sessile, not as in *a*..............**Bellwort.** (*Uvularia sessilifolia.*)

36 *a*. Sepals 4; petals 4; stamens 6......................................37.

b. Flowers not completely as in *a*...................................43.

37 *a*. Basal leaves with terminal lobe only 1 or 2 times larger than the lateral lobes........................**Yellow Water-cress.** (*Roripa palustris.*)
b. Basal leaves with terminal lobe several times larger than the lateral lobes. 38.
38 *a*. Flowers about $\frac{1}{4}$ in. broad, showy and densely clustered at top of spike; leaves dark green, often shining above, not hairy.
Yellow Rocket. (*Barbarea Barbarea.*)
b. Plants not completely as in *a*.......................................39.
39 *a*. Upper leaves with bases clasping the stem.
Ruta-baga. (*Brassica campestris.*)
b. Upper leaves not as in *a*.......................................40.
40 *a*. Flowers $\frac{1}{4}$ in. or less broad.......................................41.
b. Flowers $\frac{1}{2}$–$\frac{3}{4}$ in. broad.......................................42.
41 *a*. Pods $\frac{1}{2}$–1 in. long, appressed to the stem.
Hedge Mustard. (*Sisymbrium officinale.*)
b. Pods 2–4 in. long, spreading from the stem.
Tumble Mustard. (*Sisymbrium altissimum.*)
42 *a*. Plant only slightly hairy; mature pods 1–2 in. long.
Indian Mustard. (*Brassica juncea.*)
b. Plant covered with stiff hairs; mature pods $\frac{1}{2}$–$\frac{3}{4}$ in. long.
Wild Mustard. (*Brassica arvensis.*)
43 *a*. Ovary inferior.......................................44.
b. Ovary superior.......................................48.
44 *a*. Petals 4; flowers 1–2 in. broad.............**Sundrop.** (*Kneiffia pumila.*)
b. Petals usually 5; flowers $\frac{1}{4}$ in. or less broad.......................45.
45 *a*. Leaves simple, linear, arranged in whorls.
Yellow Bedstraw. (*Galium verum.*)
b. Leaves not completely as in *a*.......................................46.
46 *a*. Fruit or ovary conspicuously winged, not flattened.
Meadow Parsnip. (*Thaspium barbinode.*)
b. Fruit not winged, somewhat flattened.............................47.
47 *a*. All leaves ternately compound; fruit oblong.
Golden Meadow Parsnip. (*Zizia aurea.*)
b. Basal leaves round-heart-shaped; fruit oval...**Alexanders.** (*Zizia cordata.*)
48 *a*. When broken plants exude a yellow juice..**Celandine.** (*Chelidonium majus.*)
b. Plants not completely as in *a*.......................................49.
49 *a*. Stamens 15 or more.......................................50.
b. Stamens 10 or less.......................................66.
50 *a*. Perianth not differentiated into green calyx and colored corolla.
Marsh Marigold. (*Caltha palustris.*)
b. Perianth differentiated into a green calyx and colored corolla.........51.
51 *a*. Pistils 1–6.......................................52.
b. Pistils 10 or more.......................................53.
52 *a*. Leaves compound, mostly basal.
Barren Strawberry. (*Waldsteinia fragarioides.*)
b. Leaves simple..................**Frostweed.** (*Helianthemum canadense.*)
53 *a*. Calyx with distinct sepals which are readily detached...............54.
b. Calyx more or less united at the base, the lobes not readily detached..61.

54 *a*. Flowers about $\frac{1}{4}$ in. broad; petals usually no longer than the sepals....55.
b. Flowers $\frac{1}{2}$ in. or more broad; petals longer than the sepals............57.
55 *a*. Head of fruit oblong or cylindric; plant stout.
Ditch Crowfoot. (*Ranunculus scleratus.*)
b. Head of fruit globose..56.
56 *a*. Basal leaves lobed; achenes with recurved beak.
Hooked Crowfoot. (*Ranunculus recurvatus.*)
b. Basal leaves round-heart-shaped, achenes not as in *a*.
Kidney-leaved Crowfoot. (*Ranunculus abortivus.*)
57 *a*. Plant creeping; leaves often spotted.
Creeping Buttercup. (*Ranunculus repens.*)
b. Plants more or less erect..58.
58 *a*. Basal leaves 3-7–divided, the divisions not stalked; plant 2–3 ft. high.
Meadow Buttercup. (*Ranunculus acris.*)
b. Basal leaves 3-divided; some of the divisions stalked.................59.
59 *a*. Lateral and terminal divisions of leaf stalked; plants only slightly hairy.
Swamp Buttercup. (*Ranunculus septentrionalis.*)
b. Only terminal division of leaf stalked; plants hairy.................60.
60 *a*. Plant with a bulbous root...**Bulbous Buttercup.** (*Ranunculus bulbosus.*)
b. Plant with fibrous roots.......**Hispid Buttercup.** (*Ranunculus hispidus*).
61 *a*. Leaves pinnately divided; flowers $\frac{1}{4}$ in. or less broad.
Spring Avens. (*Geum vernum.*)
b. Leaves palmately divided..62.
62 *a*. Plants erect; leaflets 3, 1–3 in. long.
Rough Cinquefoil. (*Potentilla monspeliensis.*)
b. Plants prostrate or ascending....................................63.
63 *a*. Leaflets 3......................**Indian Strawberry.** (*Duchesnea indica.*)
b. Leaflets usually 5 or more, or a few leaves with 3..................64.
64 *a*. Flowers in clusters; leaflets with silvery hairs beneath.
Silvery Cinquefoil. (*Potentilla argentea.*)
b. Flowers solitary on a stalk; leaflets not completely as in *a*...........65.
65 *a*. Plant 3–10 in. long; first flower from axil of first stem leaf.
Dwarf Five-finger. (*Potentilla pumila.*)
b. Plant $\frac{1}{2}$–2 ft. long; first flower from axil of second to fourth stem leaf.
Five-finger. (*Potentilla canadensis.*)
66 *a*. Leaves compound with 5 obovate or inversely heart-shaped leaflets..67.
b. Leaves not completely as in *a*....................................70.
67 *a*. Plant more or less erect, branched above; stalks of flowers erect or spreading.
Tall Yellow Wood-sorrel. (*Oxalis cymosa.*)
b. Plants more or less prostrate, branched at the base; stalks of fruit usually reflexed...68.
68 *a*. Flowers $\frac{1}{4}$–$\frac{1}{2}$ in. broad; capsule $\frac{1}{2}$–$\frac{3}{4}$ in. long, tapering to apex.
Procumbent Wood-sorrel. (*Oxalis corniculata.*)
b. Flowers $\frac{1}{2}$–$\frac{3}{4}$ in. broad; capsule $\frac{1}{2}$–1 in. long, short-pointed............69.
69 *a*. Plants with appressed hairs........**Yellow Wood-sorrel.** (*Oxalis stricta.*)
b. Plants with loose, spreading hairs.
Slender Wood-sorrel. (*Oxalis Brittoniae.*)
70 *a*. Leaves opposite.........**Tufted Loose-strife.** (*Naumburgia thyrsiflora.*)
b. Leaves alternate..71.

71 *a*. Style thread-like, longer than the corolla.
False Gromwell. (*Onosmodium virginianum.*)
b. Style not completely as in *a*.
Common Gromwell. (*Lithospermum officinalis.*)

FLOWERS GREENISH OR ELSE WITHOUT A DISTINCT PERIANTH.

72 *a*. Flowers green or greenish, or without a distinct perianth............73.
b. Flowers not as in *a*..116.
73 *a*. Leaves grass-like, linear, usually $\frac{1}{4}$ in. or less broad, 1 in. or more long...74.
b. Leaves not completely as in *a*..................................82.
74 *a*. Flowers in spikes...75.
b. Flowers in terminal panicles or umbels...........................77.
75 *a*. Spikes about $\frac{1}{4}$ in. long, solitary at the end of the flowering stalk.
Spike Rush. (*Eleocharis tenuis.*)
b. Spikes not completely as in *a*..................................76.
76 *a*. Spikes 1–3 in. long, somewhat flattened, the spikelets stalked; leaves fragrant when drying.......**Sweet Vernal Grass.** (*Anthoxanthum odoratum.*)
b. Spikes not completely as in *a*.......................**Sedge.** (*Carex.*)
77 *a*. Leaves hairy; flowers in terminal umbels.
Wood Rush. (*Juncoides campestre.*)
b. Leaves not hairy..78.
78 *a*. Flowers in top-shaped heads arranged in terminal umbels.
Rush. (*Juncus acuminatus.*)
b. Flowers not in top-shaped heads, arranged in panicles.................79.
79 *a*. Spikelets with hair-like awns about $\frac{1}{2}$ in. long.
Downy Broom-grass. (*Bromus tectorum.*)
b. Spikelets of panicle not completely as in *a*........................80.
80 *a*. Outer scale of spikelets shining; grass fragrant.
Holy Grass. (*Savastana odorata.*)
b. Outer scales of spikelet not shining; grasses not fragrant.............81.
81 *a*. Spikelet 1-flowered, comparatively broad, blunt at apex.
Mountain Rice. (*Oryzopsis asperifolia.*)
b. Spikelet 2–6-flowered, tapering to apex; grass common in lawns.
Spear-grass. (*Poa annua.*)
82 *a*. Flowers arranged compactly on a spike-like spadix which is surrounded or subtended by a leaf-like bract or spathe......................83.
b. Flowers not arranged completely as in *a*..........................86.
83 *a*. Plants with a disagreeable, skunk-like odor; bract-like spathe often streaked.
Skunk Cabbage. (*Spathyema foetida.*)
b. Plants not with a disagreeable odor...............................84.
84 *a*. Leaves compound, with 3 leaflets; plant common in woods.
Jack-in-the-Pulpit. (*Arisaema triphyllum.*)
b. Leaves simple...85.
85 *a*. Leaves arrow-shaped; leaf-like spathe green, surrounding the flowers.
Arrow Arum. (*Peltandra virginica.*)
b. Leaves ovate; leaf-like spathe white, subtending the flowers.
Water Arum. (*Calla palustris.*)

86 *a*. Flowers in a compact spike which appears lateral on a flattened flowering stalk; leaves sword-shaped.......... **Sweet Flag.** (*Acorus Calamus.*)
b. Plants not completely as in *a*.................................87.
87 *a*. Leaves in 1 or 2 whorls on an upright stem; leaves 1–4 in. long, ovate to lanceolate; styles very conspicuous.
Indian Cucumber-root. (*Medeola virginiana.*)
b. Plants not completely as in *a*.................................88.
88 *a*. Flowers arranged in globose heads ½ in. or more in diameter; leaves linear, usually 1 ft. or more long........ **Bur-reed.** (*Sparganium eurycarpum.*)
b. Plants not completely as in *a*.................................89.
89 *a*. Leaves all basal; flowers in a terminal spike.........................90.
b. Plants not completely as in *a*.................................93.
90 *a*. Leaves linear, usually 3-ribbed.... **Bracted Plantain.** (*Plantago aristata.*)
b. Leaves oblong, lanceolate, or ovate.............................91.
91 *a*. Leaves ovate, often with rounded bases.
Common Plantain. (*Plantago Rugelii.*)
b. Leaves lanceolate, oblong, or sometimes obovate..................92.
92 *a*. Plant very hairy throughout; leaves obovate to oblong.
Dwarf Plantain. (*Plantago virginica.*)
b. Plants only slightly hairy; leaves narrowly oblong-lanceolate; plant common.
Rib-grass. (*Plantago lanceolata.*)
93 *a*. Leaves hollow or tubular, pitcher-like, with a terminal lid; plant grows in bogs........................ **Pitcher Plant.** (*Sarracenia purpurea.*)
b. Plants not completely as in *a*.................................94.
94 *a*. Plants prostrate on the ground.................................95.
b. Plants more or less erect.......................................96.
95 *a*. Leaves ovate or rounded, short-stalked; anthers orange-red; plant in wet places................ **Water Carpet.** (*Chrysosplenium americanum.*)
b. Leaves awl-shaped, not stalked; plant in dry soil.
German Knot-grass. (*Scleranthus annuus.*)
96 *a*. Flowers ½–¾ in. broad, irregular, arranged in racemes; leaves basal.
Fen Orchis. (*Leptorchis Loeselii.*)
b. Plants not completely as in *a*.................................97.
97 *a*. When cut or broken plants exude a milky juice....................98.
b. Plants without a milky juice...................................101.
98 *a*. Leaves 2–4 in. long, 1–3 in. broad; flowers in umbels.
Blunt-leaved Milkweed. (*Asclepias amplexicaulis.*)
b. Plants not completely as in *a*.................................99.
99 *a*. Leaves linear, numerous....... **Cypress Spurge.** (*Euphorbia Cyparissias.*)
b. Leaves not linear..100.
100 *a*. Leaves oblong to ovate, toothed, oblique at base.
Spotted Spurge. (*Euphorbia nutans.*)
b. Leaves ovate to rounded, entire, not oblique at base.
Wild Ipecac. (*Euphorbia Ipecacuanhae.*)
101 *a*. Leaves compound, the leaflets sometimes stalked................102.
b. Leaves simple..106.
102 *a*. Leaves palmately compound; leaflets 3–11, 1–4 in. long............103.
b. Leaves not completely as in *a*.................................104.

103 *a*. Flowers 1–4 in. broad.........**Green Hellebore.** (*Helleborus viridis.*)
b. Flowers $\frac{1}{4}$ in. or less broad....**Black Snake-root.** (*Sanicula marylandica.*)
104 *a*. Leaflets 2–4 in. long, toothed...**Wild Sarsaparilla.** (*Aralia nudicaulis.*)
b. Leaflets $\frac{1}{2}$–2 in. long, somewhat lobed at apex......................105.
105 *a*. Flowers perfect; sepals 6; petals 6; stamens 6.
Blue Cohosh. (*Caulophyllum thalictroides.*)
b. Flowers imperfect; perianth 4 or 5 parted; stamens numerous.
Early Meadow Rue. (*Thalictrum dioicum.*)
106 *a*. Leaves mostly basal, 4–10 in. long, oblanceolate; flowers arranged in a panicle................**Swamp Saxifrage.** (*Saxifraga pennsylvanica.*)
b. Plants not completely as in *a*.....................................107.
107 *a*. Leaves with toothed, lobed, or wavy margins.....................108.
b. Leaves with entire margins.....................................110.
108 *a*. Leaves rounded, with 7–9 rounded lobes.
Alum Root. (*Heuchera americana.*)
b. Leaves not rounded..109.
109 *a*. Basal leaves with two basal, spreading lobes.
Field Sorrel. (*Rumex Acetosella.*)
b. Basal leaves not lobed...........**Swamp Dock.** (*Rumex verticillatus.*)
110 *a*. Leaves ovate, 3–12 in. long, not all basal; flowers $\frac{1}{2}$–1 in. broad, the perianth 6-parted.......................**White Hellebore.** (*Veratrum viride.*)
b. Plants not completely as in *a*.....................................111.
111 *a*. Leaf-like branches narrowly linear, 1 in. or less long; flowers about $\frac{1}{4}$ in. long, perianth 6-parted...........**Asparagus.** (*Asparagus officinalis.*)
b. Plants not completely as in *a*.....................................112.
112 *a*. Leaves 3–4, all basal, 4–8 in. long; flowers $\frac{1}{2}$–1 in. long.
Clintonia. (*Clintonia borealis.*)
b. Plants not completely as in *a*.....................................113.
113 *a*. Plants with tendrils; flowers with bad odor.
Carrion Flower. (*Smilax herbacea.*)
b. Plants not with tendrils...114.
114 *a*. Flowers $\frac{3}{4}$ in. or more long; leaves 1–3 in. long.
Bellwort. (*Uvularia sessilifolia.*)
b. Flowers $\frac{1}{4}$–$\frac{3}{4}$ in. long; leaves 2–6 in. long.........................115.
115 *a*. Leaves hairy beneath, especially on the veins; flowers $\frac{1}{4}$–$\frac{1}{2}$ in. long.
Hairy Solomon's Seal. (*Salomonia biflora.*)
b. Leaves not hairy beneath; flowers $\frac{1}{2}$–$\frac{3}{4}$ in. long.
Smooth Solomon's Seal. (*Salomonia commutata.*)

Flowers neither yellow nor green.

116 *a*. Several small flowers collected into a dense head which is subtended by an involucre of bracts, as in the Daisy, not as in Clover..........117.
b. Flowers not arranged completely as in *a*.........................134.
117 *a*. At least the outer flowers of the head with an irregular or strap-shaped corolla...118.
b. None of the flowers in the head with a strap-shaped corolla..........124.
118 *a*. Leaves pinnately divided into linear or lanceolate segments.
Corn Camomile. (*Anthemis arvensis.*)
b. Leaves not completely as in *a*.....................................119.

119 *a.* Leaves all basal, plant usually cultivated.
Garden Daisy. (*Bellis perennis.*)
b. Leaves not all basal..120.
120 *a.* Heads 1–2 in. broad, ray flowers white; leaves often pinnatifid.
White Daisy. (*Chrysanthemum Leucanthemum.*)
b. Plants not completely as in *a*..................................121.
121 *a.* Heads 1–2 in. broad, ray flowers violet or purplish; stem not usually branched above.............**Robin's Plantain.** (*Erigeron pulchellus.*)
b. Heads usually ½–1 in. broad; stem usually branched above..........122.
122 *a.* Ray flowers rose-purple, 100 or more to each head.
Philadelphia Fleabane. (*Erigeron philadelphicus.*)
b. Ray flowers white or purple tinged, 70 or less to each head..........123.
123 *a.* Stem leaves with toothed margins...**Sweet Scabious.** (*Erigeron annuus.*)
b. Stem leaves with entire margins.....**Daisy Fleabane.** (*Erigeron ramosus.*)
124 *a.* Leaves with spiny-toothed margins.
Blessed Thistle. (*Cnicus benedictus.*)
b. Leaves not with spiny-toothed margins..........................125.
125 *a.* Leaves all basal, or wanting at flowering time; flowers pink to purple; heads small, in dense racemes............**Butter-bur.** (*Petasites Petasites.*)
b. Plants not completely as in *a*..................................126.
126 *a.* Leaves not white-woolly beneath; plant 1–4 ft. high.
Daisy Fleabane. (*Erigeron ramosus.*)
b. Leaves white-woolly beneath....................................127.
127 *a.* Bracts of the involucre yellow.............**Cudweed.** (*Gifola germanica.*)
b. Bracts of the involucre not yellow..............................128.
128 *a.* No conspicuous basal leaves present.
Purple Cudweed. (*Gnaphalium purpureum.*)
b. Both basal and stem leaves present; flowers whitish................129.
129 *a.* Basal leaves ¼–¾ in. broad, distinctly 1-nerved....................130.
b. Basal leaves ½–2 in. broad, distinctly 3–5-nerved...................132.
130 *a.* Basal leaves ¾–1 in. long, ovate; stolons leafy throughout.
Small Cat's-foot. (*Antennaria neodioica.*)
b. Basal leaves 1–3 in. long, oblanceolate...........................131.
131 *a.* Stolons leafy only toward the tips.
Field Cat's-foot. (*Antennaria neglecta.*)
b. Stolons leafy throughout...**Canadian Cat's-foot.** (*Antennaria canadensis.*)
132 *a.* Plant with purplish, glandular hairs; young leaves usually not hairy above.
Parlin's Cat's-foot. (*Antennaria Parlinii.*)
b. Plant not with glandular hairs; young leaves hairy above..............133.
133 *a.* Basal leaves 1–3 in. long, with petioles usually shorter than the blades.
Plantain-leaved Everlasting. (*Antennaria plantaginifolia.*)
b. Basal leaves 2–5 in. long, with petioles as long as the blade.
Tall Cat's-foot. (*Antennaria fallax.*)
134 *a.* Flowers small, arranged compactly on a spike-like spadix which is surrounded or subtended by a leaf-like bract or spathe...............135.
b. Flowers not arranged completely as in *a*..........................136.
135 *a.* Plant with a disagreeable, skunk-like odor; spathe encloses the spadix.
Skunk Cabbage. (*Spathyema foetida.*)

b. Plants not with a disagreeable odor; spathe only subtending the spadix.
Water Arum. (*Calla palustris.*)
136 *a*. Plant with no part green, parasitic....................137.
b. Plant with green stem and green leaves....................138.
137 *a*. Plant whitish; flowers solitary..........**Cancer-root.** (*Thalesia uniflora.*)
b. Plant light-brown; flowers several..**Squaw-root.** (*Conopholis americana.*)
138 *a*. Flowers irregular (*i. e.*, with one petal different from the others)......139.
b. Flowers regular....................200.
139 *a*. Ovary inferior; leaves with entire margins....................140.
b. Ovary superior....................142.
140 *a*. Flowers with a large, inflated, pink lip 1 in. or more long; leaves 2, basal.
Moccasin-flower. (*Cypripedium acaule.*)
b. Flowers rose-purple, not completely as in *a*....................141.
141 *a*. Leaves ovate, 2–5 in. long; flowers 3–6 together.
Showy Orchis. (*Galeorchis spectabilis.*)
b. Leaves linear, 3–6 in. long; flowers usually solitary.
Arethusa. (*Arethusa bulbosa.*)
142 *a*. Flowers with the petals not united into a tube....................143.
b. Flowers with the corolla or colored parts of perianth more or less tubular.
177.
143 *a*. Leaves compound....................144.
b. Leaves simple....................157.
144 *a*. Leaves palmately compound; leaflets 7–11...**Lupine.** (*Lupinus perennis.*)
b. Leaves pinnately compound, or with 3 leaflets....................145.
145 *a*. Leaves tendril-bearing at the ends....................146.
b. Leaves not tendril-bearing at the ends....................151.
146 *a*. Some stipules $\frac{1}{2}$ in. or more long, sharply toothed only at the base.....147.
b. Stipules usually less than $\frac{1}{2}$ in. long, or toothed all around...........150.
147 *a*. Flowers yellow-white................**Vetchling.** (*Lathyrus ochroleucus.*)
b. Flowers purplish....................148.
148 *a*. Stipules 1–2 in. long, nearly as large as the leaflets.
Beach Pea. (*Lathyrus maritimus.*)
b. Stipules $\frac{1}{2}$–1 in. long, not more than half as long as leaflets...........149.
149 *a*. Stem winged; leaflets lanceolate to linear.
Marsh Vetchling. (*Lathyrus palustris.*)
b. Stem not winged; leaflets oval to oblong.
Marsh Pea. (*Lathyrus myrtifolius.*)
150 *a*. Flowers whitish; stipules linear to lanceolate.
Carolina Vetch. (*Vicia caroliniana.*)
b. Flowers purplish; stipules triangular-ovate.
American Vetch. (*Vicia americana.*)
151 *a*. Leaves doubly compound; flowers in racemes.
Pink Corydalis. (*Capnoides sempervirens.*)
b. Leaves compound with 3 leaflets; flowers in heads.................. 152.
152 *a*. Flowers crimson; head oblong, 1–3 in. long.
Crimson Clover. (*Trifolium incarnatum.*)
b. Flowers red, pink, or white....................153.
153 *a*. Heads oblong, very silky, grayish; plant hairy; flowers whitish.
Rabbit-foot Clover. (*Trifolium arvense.*)

b. Heads ovoid to globose, not grayish .... 154.
154 *a.* Heads ovoid; flowers red to purple; plant somewhat hairy .... 155.
b. Heads globose; flowers pink to white; plants not hairy .... 156.
155 *a.* Leaflets usually spotted near the middle; leaflets finely toothed.
Red Clover. (*Trifolium pratense.*)
b. Leaflets not spotted; leaflets entire.
Mammoth Clover. (*Trifolium medium.*)
156 *a.* Flowers pink to white; plant not rooting at the nodes.
Alsike Clover. (*Trifolium hybridum.*)
b. Flowers white; plant rooting at the nodes.
White Clover. (*Trifolium repens.*)
157 *a.* Plant 5 ft. or more long, twining.
Dutchman's Pipe. (*Aristolochia macrophylla.*)
b. Plant less than 5 ft. long, not twining .... 158.
158 *a.* Flowers without a spur on the petals; leaves clustered near the summit of the stem .... **Fringed Milkwort.** (*Polygala paucifolia.*)
b. Flowers with 1 petal spurred or sac-like .... 159.
159 *a.* Lower petal somewhat sac-like; flowers about $\frac{1}{4}$ in. long.
Green Violet. (*Cubelium concolor.*)
b. Lower petal spurred; flowers more than $\frac{1}{4}$ in. long .... 160.

Blue and white violets.

160 *a.* Leaves all basal .... 161.
b. Leaves not all basal; flower-stalks from axils of leaves .... 173.
161 *a.* Part or all of leaves deeply lobed or cleft, not merely incised at the base .. 162.
b. Leaves not deeply lobed or cleft, sometimes incised at the base .... 164.
162 *a.* Plant hairy; lobes of leaves toothed or cleft.
Early Blue Violet. (*Viola palmata.*)
b. Plants not noticeably hairy; lobes of leaves linear .... 163.
163 *a.* Some petals with coarse hairs on inside.
Coast Violet. (*Viola Brittoniana.*)
b. Petals not with hairs on inside .... **Bird's-foot Violet.** (*Viola pedata.*)
164 *a.* Flowers white with purple veins .... 165.
b. Flowers some shade of blue or violet .... 167.
165 *a.* Leaves broadly heart-shaped or rounded; flowers fragrant.
Sweet White Violet. (*Viola blanda.*)
b. Leaves not as in *a*; flowers not fragrant .... 166.
166 *a.* Leaves ovate to oblong .... **Primrose-leaved Violet.** (*Viola primulaefolia.*)
b. Leaves lanceolate .... **Lance-leaved Violet.** (*Viola lanceolata.*)
167 *a.* Flowers fragrant; stolons present .... **English Violet.** (*Viola odorata.*)
b. Flowers not fragrant; stolons not present .... 168.
168 *a.* Leaves heart-shaped, often broader than long, not incised at base .... 169.
b. Leaves lanceolate to ovate or arrow-shaped, often incised at the base .. 172.
169 *a.* Leaves narrowly heart-shaped; base of blade spreading at right angles to the petiole; white base of flower conspicuous.
Thin-leaved Wood Violet. (*Viola obliqua.*)
b. Leaves heart-shaped to ovate; base of blade somewhat folded or hood-shaped .... 170.

170 *a*. Plants growing in wet places and swamps; flowers often darker toward the whiter base..................**Marsh Blue Violet.** (*Viola cucullata.*)
b. Plants growing in moist woods and meadows, not in swamps..........171.
171 *a*. Flowers deep violet-purple; stalks of flower usually 2 in. or less long.
Early Blue Violet. (*Viola palmata.*)
b. Flowers violet, not purplish; stalks of flowers 2 in. or more long.
Meadow Blue Violet. (*Viola papilionacea.*)
172 *a*. Plant hairy; leaves rather ovate...**Ovate-leaved Violet.** (*Viola fimbriatula.*)
b. Plant not hairy; leaves lanceolate to arrow-shaped.
Arrow-leaved Violet. (*Viola sagittata.*)
173 *a*. Flowers usually 1 in. or more broad; plant escaped from cultivation.
Heart's-ease. (*Viola tricolor.*)
b. Flowers less than 1 in. broad..................................174.
174 *a*. Flowers blue or violet; spur elongated............................175.
b. Flowers whitish or faintly tinged with violet on the outside..........176.
175 *a*. Spur about ½ in. long, as long as the petal.
Long-spurred Violet. (*Viola rostrata.*)
b. Spur about ¼ in. long, half as long as the petal.
American Dog Violet. (*Viola conspersa.*)
176 *a*. Stipules entire....................**Canadian Violet.** (*Viola canadensis.*)
b. Stipules toothed.......................**Striped Violet.** (*Viola striata.*)
177 *a*. Corolla with a spur at the base...**Blue Toadflax.** (*Linaria canadensis.*)
b. Corolla not with a spur at the base...............................178.
178 *a*. All of stem leaves alternate......................................179.
b. Some or all of stem leaves opposite or in whorls....................181.
179 *a*. Bracts subtending the flowers scarlet, very conspicuous.
Scarlet Painted-cup. (*Castilleja coccinea.*)
b. Bracts subtending the flowers not scarlet.........................180.
180 *a*. Leaves pinnately lobed or divided.
Wood Betony. (*Pedicularis canadensis.*)
b. Leaves not pinnately lobed nor divided.
Chaff-seed. (*Schwalbea americana.*)
181. *a*. Leaves in a whorl near the summit of the stem.
Fringed Milkwort. (*Polygala paucifolia.*)
b. Leaves opposite, rarely in whorls.................................182.
182 *a*. Calyx with a protuberance on the upper side.
Skullcap. (*Scutellaria pilosa.*)
b. Calyx not with a protuberance on the upper side....................183.
183 *a*. Flowers solitary or few together in the axils, not in racemes..........184.
b. Flowers not arranged as in *a*......................................191.
184 *a*. Flowers ¼–1 in. long, usually longer than broad....................185.
b. Flowers less than ¼ in. long, usually as broad as long...............189.
185 *a*. Plants creeping, with rounded or ovate-heart-shaped leaves.........186.
b. Plants erect or ascending, leaves not rounded.....................187.
186 *a*. Upper lip of corolla 2-lobed or notched; calyx about 15-nerved.
Ground Ivy. (*Glecoma hederacea.*)
b. Upper lip of corolla entire; calyx 5-nerved.
Henbit. (*Lamium amplexicaule.*)

187 *a*. Calyx 4-toothed; stamens 4.......... **Cow-wheat.** (*Melampyrum lineare.*)
b. Calyx 5-lobed or 5-parted; stamens 2.............................. 188.
188 *a*. Flowers whitish; calyx subtended by 2 bractlets.
Hedge Hyssop. (*Gratiola virginiana.*)
b. Flowers purplish; calyx not subtended by 2 bractlets.
False Pimpernel. (*Ilysanthes attenuata.*)
189 *a*. Plant densely hairy; leaves ovate, bluntly toothed or entire.
Corn Speedwell. (*Veronica arvensis.*)
b. Plant not densely hairy; leaves oblong to linear, sometimes ovate..... 190.
190 *a*. Flowers pale blue, arranged raceme-like in the axils of the leaves.
Thyme-leaved Speedwell. (*Veronica serpyllifolia.*)
b. Flowers white............... **Purslane Speedwell.** (*Veronica peregrina.*)
191 *a*. Conspicuous, ovate, entire, overlapping bracts subtend each 1–3 flowers; spike 1–3 in. long..................... **Self-heal.** (*Prunella vulgaris.*)
b. Bracts subtending the flowers not completely as in *a*................. 192.
192 *a*. Flowers $\frac{3}{4}$–1 in. long... 193.
b. Flowers $\frac{1}{2}$ in. or less long....................................... 194.
193 *a*. Stamens 2, the connective elongated and hinged to the filament.
Lyre-leaved Sage. (*Salvia lyrata.*)
b. Stamens 4, not hinged as in *a*...... **Beard-tongue.** (*Pentstemon hirsutus.*)
194 *a*. Stamens 4; flowers in panicles.... **Hare Figwort.** (*Scrophularia leporella.*)
b. Stamens 2; flowers in spikes or racemes.......................... 195.
195 *a*. Flowers $\frac{1}{4}$–$\frac{1}{2}$ in. long, in dense, long-stalked spikes.
Water Willow. (*Dianthera americana.*)
b. Flowers $\frac{1}{4}$ in. or less long....................................... 196.
196 *a*. Racemes terminal; leaves $\frac{1}{4}$–$\frac{1}{2}$ in. long.
Thyme-leaved Speedwell. (*Veronica serpyllifolia.*)
b. Racemes axillary; leaves $\frac{1}{2}$–4 in. long............................. 197.
197 *a*. Racemes densely flowered, spike-like; plant 3–10 in. long.
Common Speedwell. (*Veronica officinalis.*)
b. Racemes loosely flowered; plant $\frac{1}{2}$–3 ft. long........................ 198.
198 *a*. Leaves linear to linear-lanceolate.
Marsh Speedwell. (*Veronica scutellata.*)
b. Leaves broadly ovate to lanceolate................................ 199.
199 *a*. Stem leaves sessile...... **Water Speedwell.** (*Veronica Anagallis-aquatica.*)
b. Stem leaves petioled........ **American Brooklime.** (*Veronica americana.*)
200 *a*. Leaves linear, thick, with an onion-like odor.
Meadow Garlic. (*Allium canadense.*)
b. Leaves not with onion-like odor.................................... 201.
201 *a*. Plants growing submerged in water; leaves linear, $\frac{3}{4}$ in. or less long.
Ditch Moss. (*Philotria canadensis.*)
b. Plants not growing submerged in water........................... 202.
202 *a*. Perianth parts 3 or 6, not joined into a tube; stamens 3 or 6......... 203.
b. Flowers not completely as in *a*.................................... 217.
203 *a*. Ovary inferior; flowers usually blue................................ 204.
b. Ovary superior... 207.
204 *a*. Flowers $\frac{3}{4}$ in. or less broad....................................... 205.
b. Flowers 1 in. or more broad...................................... 206.

205 *a.* Leaves about $\frac{1}{8}$ in. broad, about $\frac{1}{2}$ the height of the stem.
Pointed Blue-eyed Grass. (*Sisyrinchium angustifolium.*)
b. Leaves about $\frac{1}{4}$ in. broad, nearly as high as the stem.
Blue-eyed Grass. (*Sisyrinchium graminoides.*)
206 *a.* Leaves $\frac{1}{4}$–$\frac{1}{2}$ in. broad; outer perianth parts 1–2 in. long.
Slender Blue Flag. (*Iris prismatica.*)
b. Leaves $\frac{1}{2}$ in. or more broad; outer perianth parts 2–3 in. long.
Large Blue Flag. (*Iris versicolor.*)
207 *a.* Flowers blue, purplish, or rose-colored............................208.
b. Flowers not colored as in *a*......................................209.
208 *a.* Flowers 1–2 in. broad, subtended by leaf-like bracts.
Spiderwort. (*Tradescantia virginiana.*)
b. Flowers $\frac{1}{4}$–$\frac{1}{2}$ in. broad...............**Twisted-stalk.** (*Streptopus roseus.*)
209 *a.* Flowers about $\frac{1}{4}$ in. or less broad.................................210.
b. Flowers $\frac{1}{2}$ in. or more broad..213.
210 *a.* Both basal and stem leaves present; flowers in wand-like racemes.
Blazing-star. (*Chamaelirium luteum.*)
b. Only stem leaves present...211.
211 *a.* Plant with tendrils, often with prickles......**Greenbrier.** (*Smilax glauca.*)
b. Plants not with tendrils..212.
212 *a.* Leaves not clasping the stem; stamens longer than the perianth.
Wild Spikenard. (*Vagnera racemosa.*)
b. Leaves somewhat clasping the stem; stamens shorter than the perianth.
Star-flowered Spikenard. (*Vagnera stellata.*)
213 *a.* Leaves 3 in a terminal whorl.....................................214.
b. Leaves mostly basal..216.
214 *a.* Flowers purple to pink, with offensive odor.
Ill-scented Wake-robin. (*Trillium erectum.*)
b. Flowers white to pink, not with offensive odor...................215.
215 *a.* Stalk of flower recurved, petals recurved, usually pink.
Nodding Wake-robin. (*Trillium cernuum.*)
b. Stalk of flower not recurved; petals usually white.
Large-flowered Wake-robin. (*Trillium grandiflorum.*)
216 *a.* Leaves lanceolate; flowers solitary.
White Adder's-tongue. (*Erythronium albidum.*)
b. Leaves linear, thick; flowers in umbels; outer side of perianth greenish.
Star-of-Bethlehem. (*Ornithogalum umbellatum.*)
217 *a.* When cut or broken plants exude a white milky sap.................218.
b. When cut or broken plants do not exude a milky sap................221.
218 *a.* Flowers with 5 petal-like hoods inside and alternate with the petals...219.
b. Flowers not completely in as *a*....................................220.
219 *a.* Some leaves in whorls of 4; flowers whitish.
Four-leaved Milkweed. (*Asclepias quadrifolia.*)
b. Leaves all opposite; flowers purplish.
Blunt-leaved Milkweed. (*Asclepias amplexicaulis.*)
220 *a.* Leaves 1–2 in. long, oblong to ovate.
Flowering Spurge. (*Euphorbia corollata.*)
b. Leaves 1–5 in. long, linear to lanceolate.
Myrtle Spurge. (*Euphorbia Lathyrus.*)

221 *a*. Petals or colored parts of the perianth joined into a tube at least at the base. . . . . 222.
b. Petals or perianth parts distinct, not joined into a tube. . . . . 263.
222 *a*. Perianth 6-lobed; leaves basal, linear, thick; flowers blue.
Grape Hyacinth. (*Muscari botryoides.*)
b. Plants not completely as in *a*. . . . . 223.
223 *a*. Leaves clustered in a single whorl at the top of the stem; flowers white.
Star-flower. (*Trientalis americana.*)
b. Leaves not clustered as in *a*. . . . . 224.
224 *a*. Leaves all basal, with 3 leaflets. . . . .**Buckbean.** (*Menyanthes trifoliata.*)
b. Leaves not all basal. . . . . 225.
225 *a*. Leaves opposite or in whorls on the stem. . . . . 226.
b. All leaves alternate. . . . . 241.
226 *a*. Flowers solitary or 2 together in the axils of the leaves. . . . . 227.
b. Flowers not arranged completely as in *a*. . . . . 233.
227 *a*. Flowers 2 together in the axils, their ovaries united; leaves thick.
Partridge Berry. (*Mitchella repens.*)
b. Plants not completely as in *a*. . . . . 228.
228 *a*. Leaves rounded; flowers purplish close to the ground; roots spicy.
Wild Ginger. (*Asarum reflexum.*)
b. Plants not completely as in *a*. . . . . 229.
229 *a*. Ovary inferior. . . . . 230.
b. Ovary superior. . . . . 231.
230 *a*. Flowers violet or blue; plant 1 ft. high or less.
Bluets. (*Houstonia coerulea.*)
b. Flowers purplish-brown; plant 2 ft. or more high.
Horse Gentian. (*Triosteum aurantiacum.*)
231 *a*. Flowers with perianth lobes fringed. . . . .**Mitrewort.** (*Mitella diphylla.*)
b. Flowers with perianth lobes not fringed. . . . . 232.
232 *a*. Flowers $\frac{3}{4}$ in. or more broad, usually blue; leaves thick, evergreen.
Myrtle. (*Vinca minor.*)
b. Flowers about $\frac{1}{4}$ in. broad, scarlet or white; leaves not evergreen.
Pimpernel. (*Anagallis arvensis.*)
233 *a*. Ovary inferior. . . . . 234.
b. Ovary superior. . . . . 239.
234 *a*. Leaves opposite. . . . .**Long-leaved Houstonia.** (*Houstonia longifolia.*)
b. Leaves in whorls. . . . . 235.
235 *a*. Plants with rough or hairy stems. . . . . 236.
b. Plants with stems smooth, not hairy. . . . . 238.
236 *a*. Leaves 6–8 in a whorl, 1–3 in. long, oblanceolate or linear.
Cleavers. (*Galium Aparine.*)
b. Leaves not completely as in *a*. . . . . 237.
237 *a*. Fruit or ovary hairy; leaves $\frac{1}{2}$–2 in. long, oval to ovate-lanceolate.
Wild Liquorice. (*Galium circaezans.*)
b. Fruit or ovary not hairy; leaves $\frac{1}{4}$–$\frac{3}{4}$ in. long, linear to oblanceolate.
Clayton's Bedstraw. (*Galium Claytoni.*)
238 *a*. Leaves 6–8 in a whorl. . . . .**Wild Madder.** (*Galium Mollugo.*)
b. Leaves usually 4 in a whorl. . . . . .**Marsh Bedstraw.** (*Galium tinctorium.*)

239 *a*. Corolla tube much shorter than the lobes.
Marsh Pink. (*Sabbatia campanulata.*)
b. Corolla tube nearly as long as the lobes........................240.
240 *a*. Plant prostrate; leaves usually ½ in. or less long; plant cultivated in gardens.
Ground Pink. (*Phlox subulata.*)
b. Plant erect; leaves 1–3 in. long..........**Downy Phlox.** (*Phlox pilosa.*)
241 *a*. Plant creeping, with rounded leaves; perianth 3-lobed, purplish; roots spicy.
Wild Ginger. (*Asarum reflexum.*)
b. Plants not completely as in *a*..................................242.
242 *a*. Ovary inferior; leaves rounded, with clasping bases; flowers blue.
Venus' Looking-glass. (*Specularia perfoliata.*)
b. Ovary superior..243.
243 *a*. Flowers about ¼ in. or less broad...............................244.
b. Flowers ½ in. or more broad....................................255.
244 *a*. Leaves lobed or pinnately compound.
Water-leaf. (*Hydrophyllum virginicum.*)
b. Leaves with entire or wavy-toothed margins....................245.
245 *a*. Corolla tube closed by 5 scales attached opposite the corolla lobes.....246.
b. Corolla tube not completely as in *a*.............................248.
246 *a*. Basal leaves 2–4 in. long or wanting; nutlets erect or incurved.
Stickseed. (*Lappula Lappula.*)
b. Basal leaves 5–18 in. long; nutlets spreading......................247.
247 *a*. Flowers reddish-purple to white.
Hound's-tongue. (*Cynoglossum officinale.*)
b. Flowers blue.................**Wild Comfrey.** (*Cynoglossum virginicum.*)
248 *a*. Style thread-like, much longer than the corolla; corolla lobes erect.
False Gromwell. (*Onosmodium virginianum.*)
b. Styles not completely as in *a*; corolla lobes spreading...............249.
249 *a*. Flowers in racemes...250.
b. Flowers in umbels or panicles...................................254.
250 *a*. Racemes with numerous leafy bracts; flowers white or yellowish.....251.
b. Racemes not with numerous leafy bracts; flowers blue or white.......252.
251 *a*. Corolla without scales in the tube; mature nutlets brown, rough.
Corn Gromwell. (*Lithospermum arvense.*)
b. Corolla with scales in the tube; mature nutlets white, smooth.
Common Gromwell. (*Lithospermum officinale.*)
252 *a*. Flowers white; calyx with hooked hairs.
Early Scorpion-grass. (*Myosotis virginica.*)
b. Flowers blue; calyx not with hooked hairs.......................253.
253 *a*. Calyx lobes much shorter than the calyx tube; plants cultivated and escaped.
Forget-me-not. (*Myosotis palustris.*)
b. Calyx lobes as long as the calyx tube; plants not cultivated.
Small Forget-me-not. (*Myosotis laxa.*)
254 *a*. Flowers in panicles; perianth differentiated into calyx and corolla.
Water Pimpernel. (*Samolus floribundus.*)
b. Flowers in umbels; perianth not differentiated.
Bastard Toadflax. (*Comandra umbellata.*)
255 *a*. Leaves pinnately compound.....................................256.
b. Leaves not pinnately compound..................................257.

256 *a*. Flowers in panicles; stamens alternate with the corolla lobes.
Jacob's Ladder. (*Polemonium Van Bruntiae.*)
b. Flowers not completely as in *a*......... **Bittersweet.** (*Solanum Dulcamara.*)
257 *a*. Climbing or trailing vines.......................................258.
b. Erect herbs...260.
258 *a*. Flowers about $\frac{1}{2}$ in. broad, with 2 greenish spots at the base of each corolla lobe.......................... **Bittersweet.** (*Solanum Dulcamara.*)
b. Flowers 1 in. or more broad.......................................259.
259 *a*. Leaves heart-shaped at the base; stigma globose.
Wild Potato Vine. (*Ipomoea pandurata.*)
b. Leaves not heart-shaped at the base; stigma 2-lobed.
Upright Bindweed. (*Convolvulus spithamaeus.*)
260 *a*. Flowers 3–4 in. long, funnel-shaped, usually violet.
Purple Thorn Apple. (*Datura Tatula.*)
b. Flowers 2 in. or less long.......................................261.
261 *a*. Corolla lobes spreading at right angles to the corolla tube, salver-shaped.
Blue Phlox. (*Phlox divaricata.*)
b. Corolla more or less funnel-shaped...............................262.
262 *a*. Flowers about 1 in. long, blue........... **Bluebells.** (*Mertensia virginica.*)
b. Flowers $\frac{1}{2}$ in. or less long, reddish-purple or white.
Hound's-tongue. (*Cynoglossum officinale.*)
263 *a*. Two or more petals with a spur at the base........................264.
b. None of the petals with a spur at the base........................265.
264 *a*. Five spurs to each flower; flowers reddish.
Wild Columbine. (*Aquilegia canadensis.*)
b. Two spurs to each flower; flowers whitish.
Dutchman's Breeches. (*Bicuculla Cucullaria.*)
265 *a*. Leaves simple, with entire or toothed margins, not lobed...........266.
b. Leaves compound, dissected, or lobed..............................291.
266 *a*. Some or all of the leaves opposite or in whorls on the stem..........267.
b. All leaves alternate or basal......................................277.
267 *a*. Leaves in a single whorl beneath the single white flower.
Rue Anemone. (*Syndesmon thalictroides.*)
b. Plants not completely as in *a*.....................................268.
268 *a*. Flowers with 2 sepals; leaves usually 2, linear; plants common.
Spring Beauty. (*Claytonia virginica.*)
b. Plants not completely as in *a*.....................................269.
269 *a*. Calyx tubular with 4 or more lobes or teeth; flowers pink.
Wild Pink. (*Silene caroliniana.*)
b. Calyx with separate sepals, or sepals wanting.......................270.
270 *a*. Petals 5, deeply notched, appearing like 10........................271.
b. Petals 5, not deeply notched.......................................273.
271 *a*. Leaves ovate; styles 3............. **Common Chickweed.** (*Alsine media.*)
b. Leaves oblong to linear; styles 5..................................272.
272 *a*. Stem with sticky hairs; leaves oblong.
Mouse-ear Chickweed. (*Cerastium vulgatum.*)
b. Stem not with sticky hairs; leaves linear.
Field Chickweed. (*Cerastium arvense.*)

273 *a.* Stamens of the same number as the sepals.
Pearlwort. (*Sagina procumbens.*)
b. Stamens twice as many as the sepals. . . . . 274.
274 *a.* Leaves about $\frac{1}{4}$ in. long, awl-shaped to ovate. . . . . 275.
b. Leaves $\frac{1}{2}$ in. or more long. . . . . 276.
275 *a.* Leaves ovate; flowers about $\frac{1}{8}$ in. broad.
Thyme-leaved Sandwort. (*Arenaria serpyllifolia.*)
b. Leaves awl-shaped; flowers about $\frac{1}{2}$ in. broad.
Pine-barren Sandwort. (*Arenaria caroliniana.*)
276 *a.* Leaves 1–4 in. long, all basal; plant common.
Early Saxifrage. (*Saxifraga virginiensis.*)
b. Leaves $\frac{1}{2}$–1 in. long, oval to oblong. . . . **Sandwort.** (*Moehringia lateriflora.*)
277 *a.* Flowers white; perianth not differentiated; leaves 2 or 3.
False Lily-of-the-Valley. (*Unifolium canadense.*)
b. Plants not completely as in *a*. . . . . 278.
278 *a.* Petals 4; sepals 4; stamens usually 6. . . . . 279.
b. Petals 5 or more. . . . . 287.
279 *a.* Pods or ovaries usually less than twice as long as broad. . . . . 280.
b. Pods or ovaries elongated, usually more than twice as long as broad. . . 281.
280 *a.* Flowers purple, about $\frac{3}{4}$ in. broad. . . . . **Honesty.** (*Lunaria annua.*)
b. Flowers white, $\frac{1}{2}$ in. or less broad. . . **Horse-radish.** (*Roripa Armoracia.*)
281 *a.* Flowers $\frac{3}{4}$–1 in. broad, purple or white, fragrant.
Dame's Violet. (*Hesperis matronalis.*)
b. Flowers $\frac{1}{2}$ in. or less broad. . . . . 282.
282 *a.* Basal leaves usually rounded. . . . . . . **Bulbous Cress.** (*Cardamine bulbosa.*)
b. Basal leaves not rounded. . . . . 283.
283 *a.* Plant usually 1 ft. or more high; stem leaves present. . . . . 284.
b. Plant 1 ft. or less high; stem leaves usually wanting. . . . . 286.
284 *a.* Stem leaves not with clasping bases. . . **Sickle-pod.** (*Arabis canadensis.*)
b. Stem leaves with clasping bases. . . . . 285.
285 *a.* Basal leaves 1–2 in. long; pods erect. . **Hairy Rock-cress.** (*Arabis hirsuta.*)
b. Basal leaves 2–4 in. long; pods recurved.
Smooth Rock-cress. (*Arabis laevigata.*)
286 *a.* Basal leaves 1–2 in. long. . . **Mouse-ear Cress.** (*Stenophragma Thaliana.*)
b. Basal leaves 1 in. or less long. . . . . **Whitlow-grass.** (*Draba verna.*)
287 *a.* Leaves thick and fleshy. . . . . **Wild Stonecrop.** (*Sedum ternatum.*)
b. Leaves not as in *a*. . . . . 288.
288 *a.* Leaves round-heart-shaped. . . . . 289.
b. Leaves obovate to oval. . . . . 290.
289 *a.* Plant prostrate; flowers $\frac{1}{4}$–$\frac{1}{2}$ in. broad.
Common Mallow. (*Malva rotundifolia.*)
b. Plant erect; flowers 1–2 in. broad. . . . **High Mallow.** (*Malva sylvestris.*)
290 *a.* Leaves all basal. . . . . **Early Saxifrage.** (*Saxifraga virginiensis.*)
b. Leaves not all basal. . . . . **Pimpernel.** (*Samolus floribundus.*)
291 *a.* Ovary inferior; flowers in umbels; petals 5; stamens 5. . . . . 292.
b. Ovary superior; flowers not completely as in *a*. . . . . 296.
292 *a.* Leaves 3; leaflets 3–5; flowers white, at summit of plant.
Ground-nut. (*Panax trifolium.*)
b. Plants not completely as in *a*. . . . . 293.

293 *a.* Ovary covered with coarse hairs or bristles........................294.
b. Ovary either smooth or covered with very fine hairs..............295.
294 *a.* Ovary ovoid, covered with hooked bristles.
Snake-root. (*Sanicula marylandica.*)
b. Ovary linear, covered with coarse hairs.
Sweet Cicely. (*Washingtonia Claytoni.*)
295 *a.* Leaves finely dissected into linear segments....**Caraway.** (*Carum Carui.*)
b. Leaflets ovate, not dissected.....**Chervil.** (*Chaerophyllum procumbens.*)
296 *a.* When broken plants exude a reddish sap; flowers white.
Blood-root. (*Sanguinaria canadensis.*)
b. Plants not completely as in *a*...................................297.
297 *a.* Perianth not differentiated into green calyx and colored corolla.......298.
b. Perianth differentiated.......................................304.
298 *a.* Flowers reddish, about $\frac{1}{8}$ in. broad; leaves with basal lobes.
Field Sorrel. (*Rumex Acetosella.*)
b. Flowers not completely as in *a*.................................299.
299 *a.* Flowers about 2 in. broad, white, borne singly in the axils of the 2 umbrella-like leaves......................**Mandrake.** (*Podophyllum peltatum.*)
b. Plants not completely as in *a*...................................300.
300 *a.* All leaves basal or wanting at flowering time.........................301.
b. Stem leaves present..302.
301 *a.* Leaves 3-lobed; flowers subtended by calyx-like involucre.
Hepatica. (*Hepatica Hepatica.*)
b. Leaves with 3 leaflets...................**Goldthread.** (*Coptis trifolia.*)
302 *a.* Flowers white in compact or elongated racemes or spikes.
Baneberry. (*Actaea alba.*)
b. Flowers solitary on elongated stalks...............................303.
303 *a.* Leaflets rounded or oblong, somewhat 3-lobed.
Rue Anemone. (*Syndesmon thalictroides.*)
b. Leaflets variously toothed, lobed or divided, not with rounded lobes.
Anemone. (*Anemone quinquefolia.*)
304 *a.* Sepals 4; petals 4..305.
b. Sepals 5 or more...314.
305 *a.* Leaves palmately 3–5-divided; flowers white or pink................306.
b. Leaves not palmately divided....................................307.
306 *a.* Stem leaves usually 3; leaflets lanceolate.
Pepper-root. (*Dentaria laciniata.*)
b. Stem leaves usually 2; leaflets ovate.....**Crinkle-root.** (*Dentaria diphylla.*)
307 *a.* Pods or ovaries triangular, notched at apex.
Shepherd's Purse. (*Bursa Bursa-pastoris.*)
b. Pods or ovaries not triangular...................................308.
308 *a.* Pods or ovaries rounded, much flattened.........................309.
b. Pods or ovaries much longer than broad.........................310.
309 *a.* Stem leaves clasping at the base......**Field Cress.** (*Lepidium campestre.*)
b. Stem leaves not clasping..........**Pepper-grass.** (*Lepidium virginicum.*)
310 *a.* Stem leaves usually entire or slightly tolthed........................311.
b. Stem leaves usually pinnatifid..................................312.
311 *a.* Basal leaves 1–2 in. long.......**Lyre-leaved Rock Cress.** (*Arabis lyrata.*)
b. Basal leaves 3–7 in. long...............**Sickle-pod.** (*Arabis canadensis.*)

312 *a*. Segments of leaves usually oval or obovate; pods spreading.
Wood Bitter-cress. (*Cardamine flexuosa.*)
b. Segments of leaves usually oblong or linear; pods erect or ascending...313.
313 *a*. Plant branched, about 1 ft. or more high.
Pennsylvania Bitter-cress. (*Cardamine pennsylvanica.*)
b. Plant not branched, very slender, usually less than 1 ft. high.
Small-flowered Bitter-cress. (*Cardamine parviflora.*)
314 *a*. Calyx lobes 2 or 3; petals 2 or 3; stamens 4–6.
False Mermaid. (*Floerkea proserpinacoides.*)
b. Flowers not completely as in *a*..................................315.
315 *a*. Stamens 5–10...316.
b. Stamens 15 or more..321.
316 *a*. Petals 6, smaller than the 6 sepals; stamens 6.
Blue Cohosh. (*Caulophyllum thalictroides.*)
b. Petals 5, larger than the sepals; stamens 5 or 10....................317.
317 *a*. Leaves with 3 inversely-heart-shaped leaflets.
Wood Sorrel. (*Oxalis Acetosella.*)
b. Leaves not completely as in *a*....................................318.
318 *a*. Flowers 1 in. or more broad, pale purple.
Wild Crane's-bill. (*Geranium maculatum.*)
b. Flowers ½ in. or less broad.......................................319.
319 *a*. Flowers pale-pink to whitish, in compact clusters.
Carolina Crane's-bill. (*Geranium carolinianum.*)
b. Flowers purplish, not in compact clusters..........................320.
320 *a*. Flowers about ½ in. broad.......**Herb Robert.** (*Geranium Robertianum.*)
b. Flowers about ¼ in. broad.
Small-flowered Crane's-bill. (*Geranium pusillum.*)
321 *a*. Leaves 3-lobed, all basal, sometimes wanting; flowers with 3 sepal-like bracts...............................**Hepatica.** (*Hepatica Hepatica.*)
b. Plants not completely as in *a*....................................322.
322 *a*. Leaves with 3 leaflets; flowers white................................323.
b. Leaves not with 3 leaflets...325.
323 *a*. Pistils 5......................**Indian Physic.** (*Porteranthus trifoliatus.*)
b. Pistils numerous...324.
324 *a*. Plant growing in the woods; flowering stalk usually longer than the leaves.
Wood Strawberry. (*Fragaria americana.*)
b. Plant common in fields and waste places; flowering stalk usually shorter than the leaves.............**Wild Strawberry.** (*Fragaria virginiana.*)
325 *a*. Leaves with 5–9 rounded lobes......................................326.
b. Leaves compound with several leaflets................................327.
326 *a*. Leaves mainly basal; flowers white.
False Mitrewort. (*Tiarella cordifolia.*)
b. Leaves not mainly basal; flowers purplish.
High Mallow. (*Malva sylvestris.*)
327 *a*. Flowers purple, ¾–1 in. broad............**Purple Avens.** (*Geum rivale.*)
b. Flowers cream-colored, ¼–½ in. broad.
Cream-colored Avens. (*Geum flavum.*)

PROCEEDINGS OF THE CLUB

October 10, 1911*

The meeting of October 10, 1911, was held at American Museum of Natural History at 8:15 p.m., President Rusby presiding. Forty persons were present.

The minutes of the meetings of May 8 and May 31 were read and approved. Professor R. A. Harper, Columbia University, Dr. C. W. Ballard, 115 W. 68th Street, F. D. Fromme, Columbia University, A. B. Stout, New York Botanical Garden, and Miss C. Rabinowitz, New York City, were then proposed for membership.

The report of the secretary on the method of changing the day of a regular meeting was accepted. Dr. E. B. Southwick, chairman of the Field Committee reported progress. A similar report was offered by Dr. Rusby, acting for the committee to revise the constitution.

Professor R. A. Harper, Dr. C. W. Ballard, F. D. Fromme, A. B. Stout, and Miss C. Rabinowitz were elected to membership.

The scientific program consisted of a lecture on "Some Edible and Poisonous Mushrooms," by Dr. W. A. Murrill. The lecture was illustrated with lantern slides which had been made from photographs of specimens recently collected in the vicinity of New York City and colored while the specimens were in a fresh condition, thus enabling the artists to reproduce the natural coloration of the specimens photographed. The speaker stated that the exceptionally large number of recent deaths due to poisonous species of mushrooms was no doubt attributable to the abundant crops of *Amanita phalloides* and *Amanita muscaria* which have followed the copious rainfall of this season. Slides showing the poisonous species in several stages of growth were exhibited and the special marks of identification were pointed out. Following these were shown slides of some of the edible mushrooms easily confused with the poisonous varieties. The two most characteristic features of the poisonous mushroom are the "death

* Inadvertently omitted from the January issue of Torreya.

cup" or volva, and the "ring" or annulus. The careless mushroom hunter may pull up a specimen leaving the volva still buried in the earth, or the annulus, which is a more or less fragile structure, may have already disappeared and serious consequences result from the oversight.

Dr. Murrill wished to emphasize the fact that there were no rules or tests that could be applied with certainty. It is necessary that one gathering mushrooms for eating purposes should confine his operations to such species as he knows intimately in all their various forms.

The lecture was discussed by Dr. H. H. Rusby, Dr. Thomas, E. B. Southwick, and E. C. Edwards.

Meeting adjourned.

B. O. Dodge,
Secretary

December 12, 1911

The meeting of December 12, 1911, was called to order by President Rusby at 8:15 p.m. Sixty-one persons were present. The minutes of November 14 were read and approved.

Dr. Rusby in a few remarks announced the death of Sir Joseph Hooker and an obituary notice from the *Evening Post* was read by Dr. E. B. Southwick.

The announced scientific program consisted of a lecture on "Methods of Detecting Adulterations in Foods and Drugs," by Dr. H. H. Rusby.

The lecturer stated that the methods of detecting adulterants in foods and drugs were physical and chemical. To the chemical matters he would merely make brief reference. They depend upon the well-known fact that the medicinal and nutritive values of drugs and foods, respectively, were due to certain of their constituents. The fact that these constituents are present in more or less definite percentages, enables the authorities to establish standard requirements as to these percentages. Such percentage may be lowered by the removal of part of the active constituent, or by the addition of foreign material. In either case, the article is adulterated, in the legal sense. Chemical

methods of examination are based upon the determinations of such percentages, by the extraction of the constituents in question and their subsequent identification.

In many cases an adulterant may be added in such small amount that it will not reduce the percentage of active constituent below the standard. In other cases, as to drugs, the active constituent is not known, or is not amenable to chemical determination, and for these and other reasons, the detection of adulterants by chemical methods is often impracticable, or even impossible. In many such cases, detection is possible by physical methods. In the lecturer's opinion, the number of cases in which physical methods could determine quality while chemical methods could not, was much greater than the number of those in which the conditions were reversed. Hence, the great importance of microscopical analysis, a method that is yet in its infancy.

The method of physical examination most generally useful is that of ordinary examination, by sight, touch, smell, fracture, etc., on the part of an experienced examiner, perfectly familiar with the articles, but very often, especially in the case of finely powdered substances, these methods would wholly fail. Then recourse must be had to the compound microscope. The anatomical elements of vegetable substances, however minute, are in most cases quite as distinctly characteristic as are the entire plant bodies to which they pertain, and all that is necessary is to magnify their appearance by the aid of the compound microscope.

Numerous lantern slide illustrations were employed to show the distinctive elements in various drugs and their principal adulterants, these pertaining to trichomes, epidermis, fibers, stone-cells, crystals, and starch-grains.

Meeting adjourned.

B. O. Dodge,
Secretary

January 9, 1912

The first meeting of the Club for 1912 was held at the American Museum of Natural History at 8:15 p.m. Vice-President Barnhart presided. Twenty-two persons were present.

This being the annual meeting, reports were presented by the various officers.

The report of the Treasurer was presented and upon motion referred to an Auditing Committee.

The Secretary reported that fourteen meetings had been held during the year with a total attendance of 363, and an average attendance of 26. Nine persons have been elected to membership, and eight resignations have been received and accepted. Seven illustrated lectures were delivered during the season, at which the combined attendance was 262.

The editor reported that the BULLETIN for the year 1911 contains 570 pages and 35 plates, and that the expense of its publication was slightly in excess of the amount allowed for it by the Budget Committee.

The editor of TORREYA presented a special report for that periodical.

The chairman of the Field Committee reported that twenty-five meetings were advertised during the year. The total number that took advantage of the field trips was 74. The recommendations contained in this report were adopted.

As chairman of the Local Flora Committee, Dr. N. L. Britton gave a brief report of the investigations carried on by Mr. Norman Taylor on the local flora. The work of Mr. Taylor will soon be ready for publication.

Dr. W. A. Murrill, chairman of the Committee on Cryptogamic Flora, reported that considerable progress had been made in the collection and study of local material. Many colored illustrations of the fleshy fungi from New York City, Long Island, and Massachusetts have been prepared for publication and public exhibition.

The report of the Program Committee was read and placed on file.

Dr. W. Mansfield, delegate to the council of the New York Academy of Sciences, reported that a sum of money had been set aside to be used in defraying the expenses of lectures held under the auspices of the affiliated societies. A motion was carried to apply to the Council for twenty-five dollars to pay the expenses of Dr. F. Shreve, who will lecture before the Club February 13.

The resignations of Mrs. Ruth Price Cohn, Mrs. J. N. Trainer, Misses Fanny Julien, Caroline Dana, and Catherine Murray were read and accepted. Dr. W. D. Johnston and Dr. W. Marquette, of Columbia University, Professor L. S. Hopkins, of Peabody High School, Pittsburgh, Dr. G. Bovard, University of Southern California, Los Angeles, and Miss Ellen Shaw, of New York City, were elected to membership in the Club.

The election of officers for the year 1912 resulted as follows:

President, Edward S. Burgess.

Vice-Presidents, John Hendley Barnhart and Herbert Maule Richards.

Secretary and Treasurer, Bernard O. Dodge.

Editor, Philip Dowell.

Associate Editors, John Hendley Barnhart, Jean Broadhurst, Ernest Dunbar Clark, Alexander William Evans, Robert Almer Harper, Marshall Avery Howe, Herbert Maule Richards and Norman Taylor.

Dr. W. Mansfield was elected Delegate to the Council of the New York Academy of Sciences.

The following committees were appointed by the President for the year 1912:

Finance Committee, John I. Kane and Robert A. Harper.

Program Committee, Elizabeth G. Britton, Fred J. Seaver, C. Stuart Gager and Jean Broadhurst.

Committee on Local Flora, N. L. Britton, Chairman; PHANEROGAMS, N. L. Britton, C. C. Curtis, E. P. Bicknell, K. K. Mackenzie, Norman Taylor and E. L. Morris; CRYPTOGAMS, W. A. Murrill, E. G. Britton, Tracy E. Hazen, M. A. Howe and Philip Dowell.

Budget Committee, H. H. Rusby, E. S. Burgess, M. A. Howe, J. H. Barnhart, B. O. Dodge, Philip Dowell and N. L. Britton. Meeting adjourned.

B. O. DODGE,
Secretary

NEWS ITEMS

We learn from the St. Louis *Globe-Democrat* (February 20) that the resignation of Dr. William Trelease, director of the Missouri Botanical Garden, has been accepted, with regret, by the board of trustees of that institution. Dr. Trelease gives as his reason for retirement, the necessity of greater leisure for research work. Since 1889, when he was appointed director of the Garden, at the suggestion of Asa Gray, Dr. Trelease has made the Missouri Botanical Garden one of the most important in the world. No successor has, as yet, been appointed.

Dr. H. C. Cowles, associate professor of ecology at the University of Chicago, has been elected second vice-president of the Chicago Academy of Sciences.

The London *Times* states that in the old parish church of St. Mary, Teddington, a tablet has recently been dedicated to the memory of the Rev. Stephen Hales, D.D., a former vicar of the parish and one of the most distinguished men of science of the eighteenth century. A number of eminent living *savants* have for a long time been endeavoring to discover his burial place, in order to preserve his memory, and at length the stone recording his death was found in the floor of the porch of the church with nearly the whole of the lettering obliterated. The new tablet has been placed on the wall of the west porch beneath the tower of the old church, and bears the following inscription:

"Beneath is the grave of Stephen Hales. The epitaph, now partly obliterated, but recovered from a record of 1795, is here inscribed by the piety of certain botanists, A.D. 1911. 'Here is interred the body of Stephen Hales, D.D., Clerk of the Closet to the Princess of Wales, who was minister of this parish 51 years. He died 14th January, 1761, in the 84th year of his age.'"

Mr. Francis Darwin has written for the current number of the *Parish Magazine* an interesting account of Dr. Hales, in the course of which he says: "Stephen Hales has been called the 'father of physiology,' and he deserves this title in regard both to animals and plants. His experiments on the blood pressure

of animals are second only to Harvey's work on the circulation. In the domain of plant physiology he is equally great. He treated the manifestations of life as things to be weighed, measured and analyzed in the laboratory. It is this point of view that gives his work so modern a character and entitles him to be considered one of the founders of a rational science of biology. Although he loved science for its own sake, it is equally clear that he was dominated by a permanent desire to use his knowledge for the benefit of his fellow-creatures."

It is a pleasure to report that on Wednesday the twenty-eighth of February, at the one hundred and twenty-fifth anniversary of the University of Pittsburgh, the honorary degree of Doctor of Laws was conferred on Nathaniel Lord Britton.

A new botanical museum for the University of Christiania, Norway, is being erected and will be ready for occupancy in the autumn of 1913.

Dr. C. N. Jensen, fellow in plant pathology, Cornell University, has been appointed professor of botany and plant pathology in Utah Agricultural College and Experiment Station and entered on his duties on February 1.

We learn from *Science* that Professor F. O. Grover of Oberlin College "discovered several unknown plants and extended the known distribution of other species," during last summer's work at Monhegan Island, Maine. Near Moosehead Lake, *Carex crinita Portereii*, was collected for the first time since the early seventies.

According to the New York *Evening Post* (March 2) Miss Helen Ashurst Choate has been promoted from an assistant to instructor in botany at Smith College.

Dr. and Mrs. N. L. Britton, accompanied by Mr. J. F. Cowell of the Buffalo Botanic Garden, sailed for eastern Cuba, on March second, to continue botanical explorations in the vicinity of the Sierra Maestra.

TORREYA

April, 1912

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PHYTOGEOGRAPHY AND ITS RELATION TO TAXONOMY AND OTHER BRANCHES OF SCIENCE

By P. A. Rydberg

Phytogeography in this country is almost a neglected field. Until recently no attempt had been made to give an adequate account of the phytogeography of North America or any larger part thereof. The phytogeographical sketches extant are scattered through the botanical journals and a few books on systematic botany. No attempt had been made to bring these records together until Professor Harshberger's Phytogeographic Survey of North America* appeared last year. The writer admires Professor Harshberger's courage in undertaking such a stupendous work, when in reality so little was known of the phytogeography of this continent, and still less was published. In a voluminous work, as the one there presented, compilation is not only allowable, but legitimate and altogether necessary, for it is impossible for any one person to know the flora of the whole of North America. But how is it possible to compile, in cases where there is but little or nothing to compile from.

The writer has many times been thinking of writing a phytogeographical sketch of the Rocky Mountain region, in which he has spent six summers, besides one in the Black Hills of South Dakota and two in the foot-hill region of western Nebraska. One reason for not having done so has been the lack of time. Another reason has been that he knew that the sketch had to be writen practically from his personal knowledge of the region, for very few of the records are of any great help, without con-

* Die Vegetations der Erde, vol. XIII.

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siderable sifting and digesting. The third reason has been that he has not felt himself a good enough phytogeographer to undertake it. Furthermore, the sketches that are extant, dealing with the flora of the Rocky Mountains, are not writen by phytogeographers. Brandegee, Porter, Parry, Watson, Greene, A. Nelson, M. E. Jones, and myself were, or are, mainly taxonomists, Fremont an explorer, Tweedy a surveyor and botanical collector, Merriam a zoölogist, Leiberg, Ensign and Sudworth forestry men, Cockerell an entomologist and general scientist, Clements and Ramaley ecologists, etc. It was, therefore, by no means an easy task to give a phytogeographical sketch of the Rocky Mountain region. In the writer's opinion, Professor Harshberger has not succeeded very well in this respect, not even as well as might be expected. How he has succeeded in sketching the vegetation of other parts of our country, I can not tell, as I have too little knowledge thereof to venture to express any opinion. The main reason why he did not succeed so well, was because he had very little personal knowledge of the Rockies, but I think that it depended also upon the fact that our phytogeographers, and ecologists also, do not in general realize the importance of the relationship between phytogeography on one side and taxonomy and other branches of science on the other.

It is not necessary that a good phytogeographer should be a good phytographer—he need not have described a single species of plant; neither that he should be a good systematist—he need not have studied the systematic relationship of a single group of plants; but it is important that he should be a fairly good general taxonomist, so as to know the plants he is dealing with. When a person is, by circumstances, practically confined to compilation, it is still more important that he should know the species credited to a certain region, in order to be able to sift judiciously the records. In the list of trees and shrubs of the Black Hills are enumerated by Harshberger: *Chimaphila umbellata*, *Cornus canadensis* and *Linnaea borealis* (should have been *L. americana*). Either by ignorance or by carelessness these have been included among trees and shrubs. *Cornus canadensis* is less shrubby than our strawberries, for the rhizome, the only

woody portion, is not so stout as that of the strawberry. Among the trees of the Rocky Mountains are enumerated *Pyrus sambucifolia*, an Asiatic species, *Cupressus guadalupensis*, a tree of Lower California, *Sapindus marginatus*, one from Florida, and *Prunus angustifolia*, the Chickasaw Plum, a tree of unknown origin, naturalized in eastern United States. On page 254, in the list of plants common to the Sierra Nevada, the Cascade Mountains, and the Rocky Mountains, are given among others: *Antennaria dioica* and *Arabis hirsuta*, two European plants. The only plant of the *A. dioica* group common to those regions is *A. rosea*, and the American representative of *Arabis hirsuta* is *A. ovata* Poir. Further are enumerated *Arnica Chamissonis*, a strictly boreal plant, and *Spraguea umbellata*, a plant confined to the Sierras and neighboring mountains, and represented in the Rockies by *S. multiceps* Howell. On page 249, *Spiraea betulifolia* is given as transcontinental. The species is Siberian. The only close relative it has on this continent is *S. Steveni*, an Alaskan species. *S. splendens* (= *S. arbuscula*) of California and Oregon, *S. lucida a*and *S. densiflora* of the Rockies and *S. corymbosa* of the Alleghenian region, all of which have been confused with *S. betulifolia*, have erect instead of reflexed sepals. Among the alpine plants of the Rockies are enumerated on page 192 *Smelowskia calycina*, a Siberian plant, on page 193 *Sausurea alpina* and on page 194 *Androsace Chamaejasme*, both European plants. These are represented in the Rocky Mountains by *Smelowskia americana* and *S. ovalis*, *Sausurea densa* and *S. remotifolia*, and *Androsace carinata*. On page 248 are enumerated among the immigrants from the *northwest* (Italics mine): *Alnus incana*, *Kalmia glauca*, and *Vaccinium Myrtillus*, all *northeastern* plants, represented in the Rockies by *Alnus tenuifolia*, *Kalmia microphylla*, and *Vaccinium oreophilum* and *V. scoparium*.

A good phytogeographer should not have made errors like these. It is not necessary that he should be a taxonomist of the "finely splitting kind," so that he, of his own accord, should see all those fine distinctions drawn by systematists nowadays, but he should keep up with the progress of taxonomy enough, so that he would not use determinations made by Tom, Dick, and

Harry, a half or a quarter of a century ago. It was very proper that Tweedy in 1885 and in 1886, should report, among the vegetation of the Geyser areas of the Yellowstone Park, such plants as *Chrysopsis villosa* (now known to belong to the plains of Kansas and Nebraska), *Gnaphalium Sprengelii* (a South American plant), *Panicum dichotomum* var. *pubescens*, *Castilleja minor*, *Hulsea nana* and *Botrychium ternatum* var. *australe*, for at that time the plants were known, although erroneously so, under those very names: but it is not proper now, after all the work done on the flora of the region by Tweedy, Aven Nelson, Elias Nelson, Dr. Mearns, Rose, Burglehouse, Ernst Bessey and myself, and others. A little attention paid to my Flora of Montana and the Yellowstone National Park and other more recent publications would have shown to anyone that these names meant *Chrysopsis depressa*, *Gnaphalium sulphurescens* or *G. lagopodioides*, *Panicum thermale*, *Spraguea multiceps*, *Castilleja exilis*, *Hulsea carnosa*, and *Botrychium Coulteri*. We are not surprised to see Parry in 1863 having reported for Colorado, *Papaver nudicaulis*, *Gentiana frigida* and *Pedicularis sudetica*, instead of *Papaver radicatum*, *Gentiana Romanzovii* and *Pedicularis scopulorum*. It is a little more surprising to see it done to-day (see page 565). The writer himself was perhaps excusable for enumerating among the plants of the Black Hills, in 1894 (the year when the manuscript was prepared, printed in 1896), such plants as *Neillia* (now *Opulaster*) *opulifolia* (an eastern species), *Synthyris rubra* (a northwestern plant), *Stachys aspera* (eastern), *Osmorrhiza nuda* (Californian), and *Mertensia sibirica* (Asiatic); but he would not be if he did it to-day.

A good phytogeographer should be fairly well acquainted with the nomenclature of the time. It matters little which school he follows. It would not do to simply accept and copy any name given in a certain report, without judicious sifting. If care is not taken, it may happen, as it has in Professor Harshberger's book, that the same plant may be under different names, even on the same page. On pages 192–4, we find for instance both *Alsine* (*Arenaria*) *verna* and *Arenaria* (*Alsinopsis*) *propinqua*, which, as far as the Rockies are concerned, represent the same

plant; so also *Geum Rossii* and *Sieversia turbinata*, *Gentiana frigida* and *G. Romanzovii.* On page 532, we find both *Argemone alba* and *A. platyceras.* They both stand for *A. intermedia*, the only species found in Nebraska. *A. alba* is found in Florida and *A. platyceras* is mainly Mexican.

That the same plant appears under different names on different pages is a rather common occurrence in Harshberger's book. Only a few instances may be mentioned, as *Alnus incana*, on page 248, and *A. tenuifolia*, on 250; *Agropyron divergens*, on 561, and *A. spicatum*, on 516, 536, etc.; *Aristida purpurea*, on 527, 528, 530, and 532, and *A. longiseta*, on 537 and 582; *Betula occidentalis*, on 566, *B. microphylla*, on 570, and (*B. fontinalis*) in the index; *Cercocarpus betuloides*, on 266, *C. betulifolius*, on 269 (=*C. parvifolius* Nutt.) in the index, all representing *C. montanus* Raf. It is not quite as bad when he uses different generic names on different pages, as for instance *Neillia opulifolia*, on page 566, and *Physocarpus opulifolius*, on 249; *Carduus Pitcheri*, on 399, and *Cnicus* (*Cirsium*) *Pitcheri*, on 499. *Echinacea angustifolia*, on page 522, and *E. purpurea*, on 524; do not indicate in any way that they are congeneric with *Brauneria pallida*, on 518 and 527. A little hunting in the index would probably bring to light dozens of similar cases.

A good phytogeographer should be careful about using synonymy. Harshberger's book shows more than one case of bad synonymy. Only one such case of Rocky Mountain plants may be cited. On page 192 we find *Arenaria* (*Alsinopsis*) *Rossii* R. Br. (*A. stricta* Michx.). The synonym belongs to *A. Michauxii*, as is correctly given in the index. There are also some names in the book which as far as I know have never been published, as for instance *Lewisia brachycarpa* Engelm., on page 195, and *Sieversia grandiflora*, on 562. The former is probably a typographical error for *L. brachycalyx*, although Engelmann never had it in the genus *Lewisia*, but in *Calandrinia*. What *Sieversia grandiflora* stands for, I am at a loss to know.

A good phytogeographer must be a fairly good geographer. It is not so important that he should be well versed in political or commercial geography, but he must know the physiography

of the region he is treating. He must not let the political boundaries mislead him to draw corresponding division lines between his phytogeographical provinces or districts. As far as the Rocky Mountains are concerned, Professor Harshberger has committed two serious errors in this way: (1) He has drawn the line between the northern Rockies and the southern Rockies to correspond to the international boundary between Canada and the United States. (2) He has, at least in one part of his book, included the whole of New Mexico and Arizona in the Rocky Mountain Region.

On page 546, Professor Harshbergher divides the Rocky Mountain Region into two districts: the Northern or Dominion District and the Southern or Park Mountain District, together with an eastern outlobe, the Black Hills Territory. Anyone who is well acquainted with the flora of the Rockies knows that nearly all the plants characteristic of the Canadian Rockies are also found in western Montana and northern Idaho. All the forest trees of the Canadian Rockies, the Gold Range and the Selkirks are also found, as far as I know, in the Bitter Root Mountains or in the Flathead and the Coeur d'Alene valleys. In fact, the northern Rocky Mountains, from a botanical standpoint, extend south to northern Wyoming, although many plants characteristic of the Selkirks and the Bitter Root Mountains are lacking. The Wind River Mountains may be regarded as the most southerly extension thereof. The southern Rockies, which may properly be called the Park Mountain District, do not extend farther north than to the Laramie Mountains of southern Wyoming. Between these and the Wind River Mountains is an opening, where the plains practically break through. Several of the forest trees of the southern Rockies are not found north of this break, as for instance, *Picea pungens*, *Abies concolor*, *Pinus aristata* and *P. edulis*, *Sabina monosperma* and rarely *S. utahensis*, nor any of the scrub-oaks. Of course *Larix occidentalis*, *L. Lyallii*, *Abies grandis*, *Tsuga heterophylla*, *T. Mertensiana*, *Picea albertiana*, *Pinus monticola*, *Thuja plicata*, *Sabina prostrata*, and *Taxus brevifolia* of the Canadian Rockies are not found in Colorado, but are found in western Montana and northern Idaho, and some of them extend into northern Wyoming.

In treating the coniferous forests formations of the southern or Park Mountain Region, Professor Harshberger mentions the following belts: (1) *Pinus ponderosa* belt, (2) *Pinus monticola* belt, (3) *Abies subalpina* belt. These three "belts" were evidently taken from Leiberg's Survey of the Coeur d'Alene Mountains. As stated before, this region belongs to the northern Rockies and fits poorly with the Park Region of Colorado. The low-land *Pinus ponderosa*, which gave the name to the first belt, is not found in Colorado. It is there represented by the up-land *Pinus scopulorum*, often regarded as a variety of *P. ponderosa*. *Pinus monticola* is lacking altogether. Regarding the *Abies subalpina* belt it may be remarked that Harshberger makes the following statement: "The *Abies subalpina* belt exists above 5,000 feet." This is true as far as the Coeur d'Alene region is concerned, but does it give a correct impression, when the Park Mountains of Colorado are considered? I doubt if it occurs here below 9,000 feet, and it does not form a belt, but grows scattered. In Colorado, *Picea Engelmannii*, not *Abies subalpina*, is the characteristic tree of the Subalpine zone. The three belts given above characterize better the Selkirks of the Dominion District than the Park Mountain District of southern Wyoming, Colorado, and northern New Mexico. Harshberger gives practically nothing definite concerning the zonal distribution of the trees of the latter district. The zones here are four and rather distinct. (1) The foot-hills or transition zone between the plains and the mountains proper. This could well be called the juniper or cedar belt. North of the Arkansas Divide, the characteristic woody plant is *Juniperus* or *Sabina scopulorum*, mixed with *Pinus scopulorum*, *Cercocarpus montanus*, *Rhus trilobata* and its relatives, etc. South of the Arkansas Divide the characteristic trees are *Juniperus* or *Sabina monosperma* and *Pinus edulis*. Above these is usually a belt of chaparrel consisting of scrub-oaks, service berries and skunk-brush. (2) The montane zone or pine belt, with *Pinus scopulorum*, *P. Murrayana*, *P. flexilis*, *Pseudotsuga mucronata*, *Abies concolor*, *Picea pungens*, etc., rather mixed. (3) The subalpine zone or spruce-aspen belt. On the northern cooler slopes *Picea Engelmannii* is predominant, but

mixed with *P. pungens*, *Pseudotsuga*, and *Abies lasiocarpa* (*A. subalpina*). On richer soil, there are almost pure stands of aspen, *Populus tremuloides*. On southern drier exposed ridges near the timber line *Pinus aristata* is at home. (4) Alpine zone, above the timber line, with the woody vegetation represented by low shrubs only.

As stated above, Professor Harshberger has in one place included Arizona and New Mexico in the Rocky Mountain Region. I refer to pages 244–245, where he enumerates the trees of the Rockies. In this list which enumerates 63 species are included practically all the trees found in those two states.* In the list we find the following: *Juniperus californica*, *J. virginiana*, *J. pachyphloea*, *Cupressus guadalupensis*, *Pinus chihuahuana*, *P. arizonica*, *Populus monolifera* (*P. deltoides*), *Morus microphylla* (*M. rubra*), *Juglans californica*, *J. rupestris*, *Condalia obovata*, *Olneya tesota*, *Parkinsonia Torreyana*, *Prosopis pubescens*, *P. juliflora*, *Acasia Greggii*, *Platanus Wrightii*, *Chilopsis saligna* (should have been *C. linearis*), *Arbutus Menziesii*, *Cereus giganteus*, *Sapindus marginatus*, *Prunus angustifolia*, *Pyrus sambucifolia*. Of these *Juglans californica*, *Juniperus californica* and *Arbutus Menziesii* are Pacific Coast species; *Cupressus guadalupensis*, *Sapindus marginatus*, *Prunus angustifolia* and *Pyrus* [now *Sorbus*] *sambucifolia*, I have discussed before. For *Populus monolifera* and *Juniperus virginiana*, eastern trees, should be substituted *P. Sargentii* and *J. scopulorum*. All the rest enumerated above belong either to the desert regions of Arizona and New Mexico or else to what Harshberger, on his map, has marked Western Sierra Madre. Rightly he extends this Mexi-

* Some time after writing this article, I happened to read Gray and Hooker's article on the Vegetation of the Rocky Mountains, and found that Harshberger's list is practically taken from that paper, he having omitted two species, added seven, and rearranged the order. Gray and Hooker acknowledged that they had compiled the list from Sargent's report in the 10th United States Census. Much of what is here said of Harshberger's list, applies as well to that of Gray and Hooker, and shows what errors even the best botanists may commit in compiling without sifting. The only differences between their standpoint and that of Harshberger is that in their article they treated of the whole continental divide, and Harshberger had already limited the Rocky Mountain Region before giving the list, and that their article was published over 30 years ago.

can region into Arizona. Professor Harshberger introduces his list with the following remarks (see page 244): "The mere botanical enumeration of the following species of trees gives no proper idea of the arboreal flora of the region." Certainly, as the list is made up, it does not. *Abies grandis*, common in the northwest, *Sabina monosperma*, in the south, *Populus acuminata*, *P. Wilslezeni*, *Alnus tenuifolia*, *Acer glabrum*, the two species of *Tsuga*, several of *Salix* and *Betula*, etc., are omitted. Further down, he remarks: "From the whole region oaks are conspicuously absent as trees." *Quercus macrocarpa* (found, however, only in the Black Hills) and *Q. leptophylla* are always trees; *Q. utahensis*, *Q. Gambellii*, *Q. neomexicana* and *Q. subtomentosa* are sometimes trees 20 to 30 feet high.

A good phytogeographer should carefully consider the geographical distribution of the different species; (1) not cite them from a region where they do not grow; (2) carefully consider to which regions or zone they really belong and to what extent they have invaded other districts; (3) whether they are the characteristic or primary species of a certain zone or are only incidentally found there. Many data can be had from printed reports, but as noted above many of the reports are very unreliable and most of them need verification. A good deal of personal field work is imperative, but if such is impossible or unfeasible, the same result can practically be gained by studying the collections in our greater herbaria. If Professor Harshberger had studied a little more the herbaria at the University of Pennsylvania and the Philadelphia Academy of Sciences, which are easily accessible to him, I think that many misrepresentations of the geography of individual plants could have been avoided. I shall mention only a few from the Rocky Mountain Region. On pages 246–7 is given a list of 26 *woody plants* from *California* [Italics are mine], which enter the northwest of the Rockies and extend "only as far as the Bitterroot Mountains in Idaho." In this list are included *Pinus albicaulis*, which is not really a *Californian* tree and is found in Montana east as well as west of the divide and also on the Yellowstone Plateau; *Artemisia discolor* var. *incompta* and *A. ludoviciana*, which are by no means woody and the latter

of the two originally described from Kansas and not found in California; *Rhamnus Purshiana*, which extends into southern Utah; *Rubus leucodermis*, extending to the northern part of the same state; and *Spiraea arbuscula*, wholly Californian and Oregonian. Among the "northeastern and eastern element" entering the region "southward to Idaho and Montana" are erroneously enumerated the following: *Abies balsamea*, *Picea alba* [*P. canadensis*], and *P. Mariana* are not found in the Rockies, reaching the foothills of the same only in the upper valleys of Piece and Liard rivers in Alberta. The specimens of *P. alba* or *canadensis* reported from southern Alberta, British Columbia and Montana, and seen by the writer, all belong to *P. albertiana* S. Brown. *Ulmus americana* and *Quercus macrocarpa* have been found in the region only in the Black Hills; and *Bryanthes* [*Phyllodoce*] *empetriformis* is a western not an eastern species.

On page 248 it is stated that the Southern Rocky Mountain Region is clearly distinct from the Northern Region "by the injection of floral elements derived from Mexico and the Great Basin." A list of 16 species follows. Of these *Acer glabrum* is endemic to the Rockies. *Berberis repens*, *Juniperus scopulorum*, *Clematis ligusticifolia* and *Lonicera ciliosa* are just as common in the northern as in the southern Rockies. *Artemisia dracunculoides* is eastern, but found in both. *Rosa nutkana* and *Gaulteria myrsinites* are northern, the former not found at all and the latter rarely in the southern Rockies. None of them belong to Mexico and only a few of them are found in the Basin. *Tetradymia glabrata*, enumerated among those that have entered from the northwest, belongs to the Great Basin. On page 249 is given a list of a small element "confined to the Central Mountains." In this list is included *Fraxinus anomala*, a canyon plant, not found in the mountains proper and barely reaching the region from the southwest. In the list of plants ranging from Colorado northward is enumerated *Ceanotus ovatus*, a species of the plains and prairies, extending into the region only in Colorado and the Black Hills, and *Salix irrorata*, confined to the Southern Rockies.

In the list of Great Basin plants, on page 250, are enumerated *Ceanotus velutinus* and *Physocarpus Torreyi*, both typical Rocky

Mountain Plants, which however are found also in the Basin Mountains. Among the trees and shrubs which had their "origin in Mexico" we find *Artemisia tridentata, Purshia tridentata* and *Cercocarpus ledifolius*, all Basin plants and not found in Mexico, except the first; and *Tetradymia canescens* which belongs to the Columbia plains. In the list of plants common to Sierra Nevada and the Cascade Mountains, on page 254, we find *Lonicera involucrata*, a plant common in the Rockies and extending northeast to the Hudson Bay. On page 249, it is given as transcontinental. *Luzula spicata* and *Potentilla procumbens* are said to be common to the Sierras and the Rockies "only." They are both circumpolar arctic-alpine plants.

A good illustration of carelessness in referring plants to a wrong life zone, is given on pages 192–194, where Professor Harshberger lists the alpine plants. That a plant occasionally grows at a certain high altitude, or that it is found incidentally above what seems to be the timber line, does not make it an alpine plant. In the list are found the following, which usually grow on treeless hills or ridges, but still can not be called alpine: *Arabis canescens, Vesicaria* [*Lesquerella*] *alpina, Homalobus tenuifolius, Balsamorrhiza incana, B. Hookeri, Tanacetum capitataum, T. Nuttallii, Tetradymia inermis*, and *Pentstemon secundiflorus*. The following grow on dry plains and foothills: *Solidago nana, Stenotus acaulis*, and *Pentstemon humilis*. The following wood-plants are included: *Mitella pentandra, M. trifida, Lonicera coerulea, Linnaea borealis* (should have been *L. americana*), and *Arnica fulgens. Erigeron Coulteri* and *Senecio triangularis* grow on subalpine creek banks, *Lithophragma tenella* on wet hillsides, *Arnica longifolia* and *Dodecatheon pauciflorum* in wet meadows far below the alpine zone; so also *Primula mistassinica*, which is not found in the Rockies at all, but belongs to the Hudson Bay region and the northeast. These plants, erroneously given as alpine, constitute one sixth of the list.

A good phytogeographer should differentiate between different formations due to moisture, to exposure to sun, rain, and wind, to altitude, to improper drainage, but these factors are almost wholly neglected in the treatment of the Rocky Moun-

tains. I have already pointed out the different belts or zones due to altitude in the southern Rockies, not alluded to by Harshberger. The grass lands of the Rockies he dismisses with half a page, on 561, and does not differentiate the various grass-covered areas, as for instance the lowland meadows with their practically eastern grass-flora, the table-lands with a flora similar to that of the Great Plains, the bench lands and alkali flats with their predominantly endemic species, the dry grass covered ridges, the grassy mountain slopes, covered mostly by species of *Festuca*, the mountain tops and alpine meadows, all with their characteristic grass flora. Such things are simply omitted.

A good phytogeographer should also be somewhat of a geologist. As the writer makes no claim of being such, he has omitted discussion of Professor Harshberger's geological treatment.

A good phytogeographer should also be a fair bibliographer and historian. The publications on the Rocky Mountain botany by M. E. Jones, Miss Eastwood, Blankinship and G. E. Osterhout seem to have escaped Harshberger's notice. Jones, especially, has published a good deal of taxonomic work with phytogeographical notes, and also a short but good phytogeographic sketch well worth reading.

Professor Harshberger's part on floristic work is divided in several sections, of which the fifth treats of the Prairies, Arid Plains, and Rocky Mountains. Although the first part of this section does not treat of the Rocky Mountains, I was induced to read the same. As none of the reviewers of the book has called the attention to an incongruity in this part, I may do so here. It is surprising to find that the list of botanical explorers of the Prairies and Great Plains is headed by John and William Bartram, Peter Kalm, Michaux, father and son, and Pursh. None of these early explorers, except Michaux the younger, were west of the Alleghanian Region and the eastern part of the Region of the Great Lakes. Michaux the younger, went west as far as Ohio and Tennessee, perhaps to the Mississippi River. On the map at the end of the volume, the Prairie and Great Plain Region extends from Illinois to the Rockies, and Harshberger himself in the text, on page 519, limits the eastern boundary to central

Illinois. Of course, there are isolated small prairies east thereof, perhaps as far east as western New York, but I think that all these early botanists should be excluded from the list of the explorers of the Prairie Region. They belong to the Northeast.

Of course there are many good features in Professor Harshberger's Phytogeographic Survey, as for instance his bibliographies, which will be very useful to students of phytogeography; but these good features I have omitted, for they do not bear upon my subject. This article is not intended to be, as it may seem, merely an adverse criticism of Professor Harshberger's work under a disguised title. There is something more aimed at. Not long ago, all botanical work done in this country was taxonomic work, usually known as systematic botany, although much had indeed little of "systematic" in it. Now it is different. Courses in taxonomy are almost excluded from the curriculum of many of our colleges and universities, or if not excluded, so little esteemed that students are discouraged from entering upon them. The taxonomist, whether a systematic botanist in the true sense or a phytographer, is looked upon by phytogeographers, ecologists, physiologists, cytologists, and morphologists as of a lower grade of stuff;—as if it took a less fine grain of brain to make a first class systematist than any other kind of -ist. What I have aimed to show is that the taxonomist has his place in Botany, and if his work is ignored, other -ists, who are dependent upon him, can not do good work. Professor Harshberger's Phytogeographical Survey, in a field fairly well known to me, gave me an opportunity to show to what such ignoring would lead.

New York Botanical Garden.

PISTILLODY IN ARGEMONE PLATYCERAS LINK AND OTTO.

By I. M. Lewis

The occurrence of pistillody or the conversion of stamens into pistils is by no means common, neither is it rare. It has been reported in many genera of plants and has been repeatedly

FIG. I. A teratological specimen of *Argemone platyceras*.

described by various investigators. The different types of this anomaly are too well-known to require discussion.* The teratological specimen of *Argemone platyceras* shown in the accompanying photograph was found growing in a field near Austin, Texas, May 21, 1910. But a single individual exhibiting the anomaly was observed, and although many field trips have since inci-

FIG. 2. A single pistillodium. Explanation in text.

dentally taken me through fields covered with this plant, casual observation has not so far revealed other specimens. I am convinced therefore that the occurrence of this condition is extremely rare in this species, although it is known to be of common occurrence among the Papaveraceae. All of the flowers of this individual are anomalous. The stamens are all changed to pistillodia, the petals are completely suppressed, and the pistil reduced to a

* DeVries, Hugo, Species and Varieties, Their Origin by Mutation, Chapter XIII, Pistillody in Poppies. 1906. Master-Dammer, Vegetable Teratology. Schilberszky, K., Adotsk a Virag szaporadi szerveinek rendellenes szerkezeteher. Beiträge zur abnormalen Structur der productiven Organe der Blüthe. (Abhandl. a. d. Geb. der Naturw., Herausg. v. d. Ung. Wiss. Akad., Bd. XXII, No. 4, 79 p. Mit 7 Taf. Budapest, 1892. Review in Just's Botanischer Jahresbericht 1: 465. 1892.)

rudimentary condition. The pistillodia remain for the most part separate, but in a few cases two or more are fused together. Both the anther and the filament of the stamen are affected. The filament is inflated into a somewhat irregularly terete organ, on the inner surface of which naked ovules are borne (Fig. 2). The outer side is covered with coarse, stiff sharp-pointed hairs resembling the same structures of the normal ovary. The anthers are replaced by an expanded leaf-like structure borne sessile on the stalk. This expanded portion is stigmatose along the edge and in some cases well-developed pollen is produced in this portion of the organ. All of the flowers were immature and consequently it is impossible to say whether seed could have been produced in such organs, or not.

Austin, Texas.

SHORTER NOTES

An apparently new record for Rubus Chamaemorus Linnaeus.—*Rubus chamaemorus* Linnaeus seems to be limited in its so far published range to the far northeast and north among American plants. Its occurrence south of Maine, New Hampshire and Ontario is not reported, so far as known to me.

The new record is of two specimens taken from a bed several square feet in extent in one of the bogs near Montauk Point, L. I. These plants were collected by Dr. William C. Braislin, of Brooklyn, N. Y., August 21, 1908, who recognized in the plant something not before seen by him, and they were deposited in the Museum of The Brooklyn Institute of Arts and Sciences with the request that they be named.

The occurrence of this *Rubus* on Long Island certainly is one not before suspected, and the only explanation of its occurrence in a permanent situation at Montauk Point must be due to such causes as are fully discussed by Dr. M. L. Fernald, in a recent paper containing much discussion of geographical distribution published in Rhodora, or to the direct agency of migratory birds, many of which touch Long Island in their southward flights.

E. L. Morris.

The Central Museum
of The Brooklyn Institute of Arts and Sciences.

THE COLORADO TRADESCANTIA. It may be worth while to note that *Tradescantia* sp. T. Holm, Mem. Nat. Acad. Sci. **10**: 180, from Colorado, is *T. universitatis* Ckll.* I am confident that only one species of *Tradescantia* occurs in the vicinity of Denver and Boulder; and this, as Holm remarks, is not *T. scopulorum* Rose. Dr. Rydberg believes that *T. universitatis* is probably not distinct from *T. occidentalis* (Britton) Britton, but this conclusion is based on a restriction of *occidentalis* to the plant growing from Nebraska westward, taking as the type a sheet so labelled by Dr. Britton. I do not believe this proceeding can be justified, as the original account of *occidentalis* (*T. virginiana occidentalis*, Illust. Flora **1**: 377) ascribes it to "Wisconsin to Missouri, Texas and New Mexico," citing a western range only southward, where *T. scopulorum* grows. The leaves of our plant, also, are by no means "narrowly linear."

T. D. A. COCKERELL.

BOULDER, COLORADO.

EPIPACTIS VS. PERAMIUM.—A. A. Eaton, in the Proceedings of the Biological Society of Washington,† stated: "The name *Epipactis* appears to have been first used since 1753 by Böhmer in the third edition of Ludwig's Definitiones Generum Plantarum. Although he makes no binomial combination, his genus is properly made and he gives several references to the plant designated by Linnaeus as *Satyrium repens*, now known as *Goodyera repens* R. Br., or *Peramium repens* Salisb."

Then Mr. Eaton goes on and changes fifty-one names, transferring that many species to *Epipactis*.

In looking over Böhmer's edition of Ludwig's work, Mr. Eaton's discussion seemed correct to me at first. I was reluctant, however, to adopt such a radical change, which by the way has been accepted by the authors of the New Gray Manual, and I turned to Dr. Barnhart, asking him if he could find any flaw in the argument. He said that he could not, except that the name *Epipactis* might have been used between 1753 and 1760. He suggested that Zinn might have used it. Turning to Zinn's Cata-

* Muhlenbergia **3**: 54. 1907. Nature, Nov. 1, 1906, p. 7.

† Vol. **21**: 63. 1908.

logus Plantarum Horti Academici et Agri Goettingensis, we found that the genus was adopted on page 85. He credits the genus to Haller and gives *Serapias* and *Ophrys* Linn. as synonyms. He then gave a generic diagnosis of four lines and on the following page divides the genus into two subgenera: (1) *Helleborine* and (2) *Ophrys*. The first must be regarded as the typical *Epipactis* and the first species under this subgenus is:

"*Epipactis* (*Helleborine*) *floribus obsoleteca rneis*, *raris*, *labello obtuso*, Hall. Enum. Helo. 275," and under this is given as a synonym *Serapias* Linn. Sp. 1.

The first species of Linnaeus' Species Plantarum is *Serapias Helleborine* L., the type being the same as that of *Epipactis* Adans. Mr. Eaton's fifty-one new combinations have to pass into synonymy, and the publication of the same was a waste of time and paper.

P. A. RYDBERG.

NEW YORK BOTANICAL GARDEN.

HONORARY MEMBERS OF THE TORREY CLUB

The recent death of Sir Joseph Dalton Hooker, who was an honorary member of the Torrey Botanical Club, has served to call the attention of the active members to the matter of honorary membership. It was at the meeting held February 9, 1886, that a constitutional amendment was adopted providing that "Honorary members may be chosen from botanists who have distinguished themselves by valuable original investigations, and shall be limited in number to five." At the meeting of March 9, 1886, Asa Gray was elected to honorary membership, and was the only member of this class until his death, January 30, 1888. Upon the death of Dr. Gray, the Club remained without an honorary member for more than a year.

At the meeting of April 24, 1889, five honorary members were elected, the full number authorized by the constitution. These were: Henri Baillon, Alphonse de Candolle, Joseph D. Hooker, Carl J. Maximowicz, and Julius Sachs. Maximowicz died in February, 1891, and at the meeting of April 29, 1891, Eduard Regel was elected to fill the vacancy; Regel died a year later.

No list of the entire membership of the Club, including honorary members, has been printed since May, 1889; but an examination of the minutes has not revealed the election of any new honorary member since the death of Regel in April, 1892. De Candolle died in April, 1893; Baillon in July, 1895; Sachs in May, 1897; it would appear, therefore, that unless some election has been overlooked, Sir Joseph Hooker was the only honorary member of the Torrey Botanical Club from May, 1897, until his recent death. A much more thorough search of the Club's minutes, however, would be desirable before proceeding to the election of new honorary members upon the supposition that there are now none.

J. H. BARNHART.

PROCEEDINGS OF THE CLUB

JANUARY 31, 1912

The meeting of January 31, 1912, was held in the Museum Building of the New York Botanical Garden at 3:30 P.M., Vice-President Barnhart presiding. Twenty-five persons were present.

The minutes of the meetings of November 29, 1911, and January 9, 1912, were read and approved.

Dr. Marshall A. Howe, chairman of the auditing committee reported that the committee had examined the books of the treasurer and found them to be correct. The following report of the budget committee was then presented and approved.

Estimated Income

Members' dues	$1,035.00
Sustaining members' dues	225.00
Subscriptions, *Bulletin*	700.00
Subscriptions, TORREYA	115.00
Subscriptions, *Memoirs*	150.00
Subscriptions, *Index cards*	200.00
Advertisements	100.00
Sundry items	25.00
Total	$2,550.00

Estimated Expenses

Bulletin	$1,200.00
TORREYA	520.00
Memoirs	150.00
Index cards	150.00
Salary, Secretary and Treasurer	300.00
Reprinting old *Bulletins*	100.00
Sundry items	75.00
Total	$2,495.00
Estimated balance	55.00
	$2,550.00

Dr. N. L. Britton then read a communication from President Burgess relating to field meetings. By a vote of the Club Mr. Sereno Stetson was appointed chairman of the field committee with power to choose his associates.

The resignations of Dr. John H. Barnhart and Professor Robert A. Harper, associate editors, were presented and accepted. By vote of the Club, the board of editors was given power to fill the vacancies.

The resignation of William Rives was read and accepted.

The announced scientific program consisted of the reading of papers on Sir Joseph Dalton Hooker his Life and Works, by Dr. N. L. Britton and Dr. J. H. Barnhart. Dr. Britton's paper related chiefly to the life of this distinguished botanist, and his publications relating to botany were discussed by Dr. Barnhart. As Sir Joseph Hooker was an honorary member of the Torrey Club, Dr. Barnhart took this occasion to bring before the Club the constitutional provisions relating to honorary membership and read the list of all persons who have been elected to honorary membership.*

Mr. Fred J. Seaver spoke briefly on the viability of the spores in *Pyronema*. While *Pyronema* has been made the subject of numerous research papers and is figured and treated in most of the recent text-books of general botany it still remains an unknown plant to most botanists, except to the few who have done critical work with it. There is no reason for it being so for the fungus is fairly common and is easily grown as has already been

* See page 90.

shown in previously published papers. In a recent experiment the speaker was able to show that the spores of this fungus which had been kept nearly three years in the herbarium germinated readily in hanging-drop culture. This last point should be of general interest to teachers of botany since it means that the plant can be grown and studied from living material and the old plants then placed in an envelope and kept until the next year when they can be planted and grown again. No complicated technique is necessary for the growing of *Pyronema*. A pot of garden soil should be heated. Heating can be carried on in an autoclav or sterilizing oven. If these are not to be had bake in an ordinary oven. Saturate the soil with tap water after heating and plant the spores. Growth of mycelium should be abundant in two or three days, sex organs should appear in about a week and mature ascocarps a few days later. A more detailed account of this subject will appear in the BULLETIN of the Club.

Dr. Marshall A. Howe spoke briefly on "Some Marine Algae from the Stomach of a Peruvian Green Turtle" and exhibited specimens from the source indicated, collected in Peru by Dr. Robert E. Coker. The fragments were in a good state of preservation and two of the species concerned are readily determinable, the most abundant being *Rhodyminia flabellifolia*, a common Peruvian and Chilean species and a close relative of the edible "dulse." The alga coming next in point of abundance is *Caulerpa flagelliformis ligulata*, a species occurring elsewhere in Dr. Coker's Peruvian collections but not before reported from the shores of the American continent. Fragments of a species of *Gelidium* not so certainly determinable also occur.

Dr. W. A. Murrill gave a short account of the progress of his studies on the Agaricaceae of tropical North America and also read some mycological notes relating to the Washington meeting.

Meeting adjourned.

B. O. DODGE,
Secretary

FEBRUARY 13, 1912

The meeting of February 13, 1912, was held at the American Museum of Natural History at 8:15 P.M. Twenty-three persons were present.

The announced scientific programme consisted of a lecture on "Some Botanical Features of a Desert Mountain Range," by Dr. Forrest Shreve. The lecture was illustrated with lantern slides.

Meeting adjourned.

B. O. DODGE,
Secretary

NEWS ITEMS

We learn from *Science* that a comprehensive project for research on the Cactaceae has been organized by the department of botanical research of the Carnegie Institution of Washington. Dr. J. N. Rose, of the U. S. National Museum, has been appointed research associate. He has been granted a furlough from the museum, which also furnishes working quarters and facilities for handling the living collections. Dr. N. L. Britton, who has made extensive studies of the group, has also been appointed research associate, without salary. The New York Botanical Garden also contributes its extensive collections, and some of its explorational effort to the project. Dr. D. S. Johnson, of Johns Hopkins University, and Professor J. G. Brown, of the University of Arizona, will continue their studies on the Cactaceae. Other contributions will be made by the members of the staff and co-operators of the Desert Laboratory.

At the one hundredth anniversary of the Academy of Natural Sciences of Philadelphia held March 18–21, Dr. C. Stuart Gager represented the Torrey Botanical Club and also the University of Missouri.

From the *Sun* we learn that Michael H. Lawlor, an expert in the propagation and care of trees of foreign growth and known to horticulturists in all parts of the United States, has died, aged 63 years. He was born in Ireland and came to this country

when a young man. He went to work for the Parsons nurseries in Flushing and assisted Robert S. Parsons in importing many varieties from Europe, Asia and Africa. The task of acclimating and caring for these trees was entrusted to Lawlor, who became an expert in that particular branch. At the death of Mr. Parsons Lawlor went into the nursery business on his own account. He retired about ten years ago. He is survived by his wife, three sons and two daughters.

Dr. George T. Moore, professor of plant physiology at the Shaw School of Botany, and until recently plant physiologist at the Missouri Botanical Garden, has been appointed director of the Garden to succeed Dr. William Trelease, who has lately resigned.

Dr. Marshall A. Howe represented the New York Botanical Garden at the one hundredth anniversary of the founding of the Academy of Natural Sciences of Philadelphia. He read a paper on "Reef-building and land-forming seaweeds."

Mr. Robert Cushman Murphy, curator of the division of mammals and birds at The Brooklyn Institute Museum, will sail early in May for the southern Atlantic. South Georgia, an island about one thousand miles east of Cape Horn, will be the objective point. Mr. Murphy will also be equipped for collecting marine and land plants. It is hoped that his collection will supplement those of the few collectors who have ever visited this botanically little-known region.

On Monday, April 8, excavation began for the first section of the laboratory building and plant houses of the Brooklyn Botanic Garden. The building, when completed, will be one story high, of brick faced with concrete, 240 feet long and 50 feet wide, with a maximum elevation of about 60 feet. The plans provide for four large laboratories for class use, three class rooms, a herbarium room, three library rooms, physiological and photographic dark rooms, a photographic operating room, a constant temperature room, an auditorium, thirteen private research rooms, and service rooms in the basement. Only about one fifth of the building will be constructed this year, and it is expected that this will be ready for occupancy before January 1, 1913.

The plant houses consist of a central palm house 104 × 45 feet, and 36 feet maximum height, with two north and two south wings, each 100 × 22.5 feet. Only the northeast wing will be built this year.

On April 10 work began on the construction of an artificial brook to extend for 1,500 feet through the central portion of the Garden. The April number of the Garden *Record* contains the first annual report.

TORREYA

May, 1912

Vol. 12 No. 5

THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Wilbur L. King

The county of Northampton is located on the eastern border of Pennsylvania. In shape it somewhat resembles a truncated funnel lying on its side. It was formerly a portion of Bucks county from which it was separated in 1752. When originally erected it included what is now Lehigh, Schuylkill, Carbon, Monroe, Pike, and all the other counties north of them to the state of New York. In 1772 the northwestern part of the county became Northumberland county; in 1796 Wayne county took the northeastern part; in 1811 Schuylkill county was cut off; the following year Lehigh county was formed; Monroe county was laid out in 1836 and Carbon county in 1843. The present area of Northampton county is about 380 square miles.

This territory lies south of the Kittatinny mountain, sometimes known as the Blue mountain, which is a part of the Appalachian chain. The crest of the mountain forms its northern boundary and the eastern and western boundaries of the county are formed by the Delaware and Lehigh rivers respectively. These two rivers flow through gaps in the Kittatinny mountain—the Delaware river at the Delaware Water Gap in the northeast corner of the county, and the Lehigh river at Lehigh Water Gap in the northwest corner. The direction of the rivers from these gaps is SSE. The distance along the Kittatinny mountain between the two rivers, in a straight line, is twenty-seven and a half miles. The Lehigh river flows SSE. as far as Allentown. Here it is deflected ENE., making a right angle bend and, flowing past Bethlehem and Freemansburg, it empties into the Delaware

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river at Easton. The distance between Lehigh Gap and Allentown, by water, is eighteen miles and from Allentown to Easton fourteen miles.

There are seventeen townships in the county and all but two of them lie between the two rivers and the Blue mountain. The other two lie south of the Lehigh river. On the south the county borders on Bucks county.

Northampton county may be divided into three prominent geological regions. These are the slate belt in the northern portion, the limestone belt in the middle, and the syenite or gneiss belt in the southern portion of the county.

As has already been noted, the Kittatinny mountain extends along the northern border of the county. It is a ridge of Oneida sandstone. Its narrow, rocky crest is generally of the uniform height of 1,500 to 1,600 feet above the sea. There are, however, several depressions along its crest, among them being Little Gap, four miles east of Lehigh Gap; Tot's Gap, two and one half miles west of the Delaware Water Gap; Fox's Gap, one mile west of Tot's Gap; Wind Gap, eleven miles west of the Delaware Water Gap. Probaby the most curious is the Wind Gap which is five hundred feet deep. A railroad passes through it, the crest of the mountain east and west of it being at about 1,500 feet, while the highest railroad grade level in the gap is at 978 feet. To the south of the mountain lies the Great Valley, so called by the early settlers, but in the language of the *Lenni Lenape* or Delaware river Indians it is known as the Kittatinny Valley. The mountain, no doubt, received its name from the valley, but when seen from the southern portion of the county on a clear day it has a bluish tint, hence is frequently known as the Blue mountain.

To the south of the mountain extends a steep slope of Hudson river slate which is covered by fragments of sandstone. This slate belt occupies a nearly uniform width of about nine miles from the mountain crest and has a height of approximately two hundred feet above the flat limestone belt and extends from the Delaware to the Lehigh river. It is a region of low, flat-topped hills with numerous small valleys. The soil is largely clayey in structure.

The limestone region is about eight miles wide and lies south of the slate belt. It is in reality a great plain with many intersecting, gently sloping valleys. I quote from the Second Geological Survey of Pennsylvania where it is stated that its "north border commences about half a mile north of Siegfried's Bridge and continues nearly due east until it reaches a point a little southwest of Bath. Here it makes a northward bend of about a mile and, passing through Bath, it continues with a zig-zag border almost due east to Nazareth. At the latter point it bends toward the northeast and continues in this direction through the village of Martin's Creek and then extends as a strip about half a mile wide parallel to the Delaware river as far as Belvidere." Here it leaves Pennsylvania and crosses into New Jersey. The southern border of the limestone belt is where it meets the South mountains with this exception, that at Bethlehem it continues through a break in the mountains and forms the Saucon valley basin. This limestone plain has an elevation of about 400 feet, with the hilltops approximating 450 feet. It consists largely of rich farm lands underlaid by limestone soil and maintaining some few patches of woodland.

The South mountains or Durham and Reading hills form the southern, syenite, belt. This region lies south of the Lehigh river, extending about five miles within the county limits. It is, however, actually seven miles wide if the portion which lies in Bucks county is included. The South mountains consist of parallel highland ridges which are a continuation of the Highlands of New York and New Jersey through eastern Pennsylvania ending in the Schuylkill river in Berks county. Locally, they are also known as the Lehigh mountains. They are long and narrow ridges with gentle slopes and rounded summits with a maximum altitude of 1,100 feet. Between these ridges lie valleys of rich limestone land but the soil on the mountains is rocky and poor. The mountain slopes were at one time heavily wooded but none of the original forest remains. Second growth timber has covered portions of the hills but this is occasionally denuded in patches by mountain fires. The rock formation of these ridges has been referred to the Laurentian age. Large rounded bowlders

of gneiss, once presumably a part of cliffs no longer existing, are found on the south slope of the mountain.

The limestone belt has but few streams, the drainage being principally underground through sinks. The Monocacy creek enters the limestone plain from the slate hills at Bath and empties

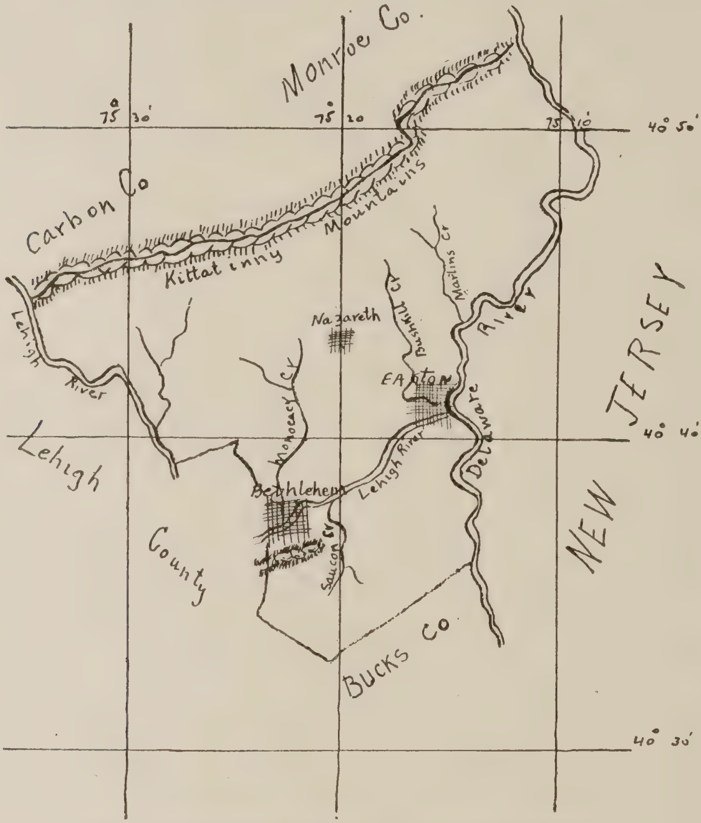

FIG. 1. Map of Northampton County, Pennsylvania.

into the Lehigh river at Bethlehem. The Saucon creek drains the beautiful Saucon Valley and flowing north empties into the Lehigh river at Freemansburg. All the rest of the streams head near the Kittatinny mountain and flow south either into the Delaware or Lehigh rivers thus flowing from the slate belt into the limestone belt.

It is probable that other conditions have as strong a bearing

on the character of the vegetation of this region as its geological environment. The altitude of its hills and mountains and the character of its soil are undoubtedly determining factors of no small moment. But its sunshine, its rain, and the period between its frosts are equally worthy of notice.

It is no less a fact that the flora of Northampton County is in a large measure the product of our climate. This is of the mountain type, with rigorous winters. At Easton the average annual snowfall is about thirty-five inches and the lowest temperature recorded in eighteen years is 14° F. below zero. The highest temperature during the same time is 99° F. For a period of twenty-five years the normal annual temperature was 50.8° F. The extremes of temperature are greater in the valleys than on the uplands. The first killing frosts of autumn generally occur about the latter part of October. The last frosts in spring are usually during the month of April. The average number of rainy days with a precipitation of .01 inch or more was 114 per annum.

The following table, covering a period of ten years, taken from the records of the Weather Bureau of the United States Department of Agriculture showing the monthly, annual, and average precipitation in inches and hundredths for Bethlehem, will, no doubt, be of considerable interest. The elevation of Bethlehem is given as 260 feet.

Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1888	5.08	3.50	3.84	3.30	2.84	3.12	2.64	9.20	10.93	2.77	3.82	3.60	54.64
1889	4.66	1.94	3.35	4.30	4.30	5.28	9.93	4.10	6.14	3.30	8.72	1.66	57.68
1890	2.28	4.43	6.12	2.58	7.44	3.10	6.02	5.92	3.51	6.17	0.82	2.98	51.37
1891	5.62	3.88	5.38	1.96	2.29	2.44	5.80	5.45	2.53	2.66	1.89	4.11	44.01
1892	5.76	0.62	4.67	0.70	4.40	3.89	1.37	3.33	2.54	0.44	6.70	1.60	36.02
1893	2.79	6.41	2.57	3.38	4.59	2.97	1.88	4.61	2.14	2.79	3.51	2.47	40.11
1894	1.54	4.50	1.29	2.41	10.80	2.49	2.83	2.07	8.54	5.04	2.86	4.85	49.22
1895	4.04	0.89	2.31	4.46	2.33	4.48	3.84	2.96	0.63	3.69	1.66	2.61	33.90
1896	1.26	6.41	5.82	1.27	6.30	3.60	6.13	2.22	3.68	2.77	4.32	0.70	44.48
1897	2.35	2.57	2.50	3.41	6.05	4.03	4.84	3.64	2.10	1.22	5.99	4.22	42.92
M'ns	3.53	3.51	3.78	2.77	5.13	3.54	4.53	4.35	4.27	3.09	4.03	2.88	45.43

In addition to its geology and climate, its commerce is another factor which must be taken into consideration in a survey of

the flora of the county, at the present time. In observing the plants growing in this region it is particularly noticeable that many of the species are not natives of the soil but have been introduced from other lands. The seeds have been scattered through the importation of products from other states and countries, and we find to-day that about twenty-five per cent. of our flora is exotic. Through changes of physical environments some of our indigenous species have become extinct in this locality. Even some of the localities have become extinct as will be noted by the reference to plants found on Calypso Island. This island comprised about twenty acres of woodland and was situated in the Lehigh river at Bethlehem, a part of it being in Northampton county. About seven years ago its large and beautiful trees were cut down and the island dug away and the south channel of the river filled in to become the roadbed of a railroad.

In the following list grateful acknowledgment is made to Dr. Porter's Flora of Pennsylvania for many species noted therein as having been found in the county; also to Mr. John A. Ruth and Mr. George W. Caffrey both of Bethlehem who have kindly furnished notes from their herbaria. The writer's herbarium contains a majority of the plants noted.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Professor Englemann had a specimen collected by E. Durand at Bethlehem in 1853 with small lanceolate fronds; most of the plants, however, were immature. (Bull. Torrey Club **24**: 548. 1897.)

BOTRYCHIUM VIRGINIANUM (L.) Sw. In woods on Lehigh Mt. Variable in size. July 19, 1897.

OSMUNDACEAE

OSMUNDA REGALIS L. In marshy ground along mountain streams on Lehigh Mt. about one mile from South Bethlehem at an altitude of about 940 feet. May 30, 1900.

OSMUNDA CINNAMOMEA L. Along the banks of mountain streams in rocky soil on Lehigh Mt.; also along the Lehigh river. Common. May 20, 1897.

OSMUNDA CLAYTONIANA L. In open woods on Lehigh Mt. and in association with the preceding. May 30, 1897.

POLYPODIACEAE

ONOCLEA SENSIBILIS L. Along the banks of the Lehigh river and Monocacy creek. In moist soil on Lehigh Mt. July 15, 1899.

MATTEUCCIA STRUTHIOPTERIS (L.) Todaro. Reported by Mr. H. W. Pretz as having been found along the Hokendauqua creek and near Nazareth, but now extinct at these places. (Bull. Torrey Club **38**: 68.)

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. On open hillsides, Lehigh Mt. Growing in patches.

DRYOPTERIS ACROSTICHOIDES (Michx.) Kuntze. On rocky hillsides and in woods on Lehigh Mt. June 5, 1897.

Dryopteris noveboracensis (L.) A. Gray. In woods on Lehigh Mt. (J. A. Ruth.)

Dryopteris Thelypteris (L.) A. Gray. Along mountain streams near Lehigh University. (J. A. Ruth.)

Dryopteris marginalis (L.) A. Gray. Common along the Lehigh river and in rocky woods on Lehigh Mt. July 15, 1899.

Phegopteris Phegopteris (L.) Underw. Along mountain streams, Lehigh Mt. (J. A. Ruth.)

Camptosorus rhizophyllus (L.) Link. On limestone rocks in shaded situations along Monocacy creek two miles from Bethlehem.

Asplenium ebenoides R. R. Scott. On limestone rocks on the Lehigh river near Easton. (Porter.)

Asplenium Trichomanes L. On limestone rocks near Freemansburg. Sept. 4, 1899.

Asplenium montanum Willd. At Weyget above Easton. (Porter.)

Asplenium acrostichoides Sw. Along mountain streams, Lehigh Mt. (J. A. Ruth.)

Asplenium Filix-foemina (L.) Bernh. Along the Lehigh canal and river. July 15 to Sept. 4, 1899. Common.

Adiantum pedatum L. Common in woods on Lehigh Mt. Preferring moist situations. July 4, 1900.

Pteridium aquilinum L. (Kuhn). In dry open woods, Lehigh Mt. July 1, 1899.

Pellaea atropurpurea (L.) Link. On limestone rocks near Freemansburg. Sept. 4; also at Easton.

Polypodium vulgare L. In woods on Lehigh Mt.; in rocky situations near Wind Gap.

EQUISETACEAE

Equisetum arvense L. In sandy soil along Lehigh river and Monocacy creek. May, 1897.

Equisetum hyemale L. In thickets along Monocacy creek. May, 1898.

SELAGINELLACEAE

Selaginella apus (L.) Spring. Along cold brooks on Lehigh Mt. July 29, 1899.

PINACEAE

Pinus Strobus L. In cultivation in cemetery at Bethlehem.

Pinus virginiana Mill. In sandy soil. (Porter.)

Pinus rigida Mill. In dry, sandy or rocky soil. (Porter.)

Tsuga canadensis (L.) Carr. In stony or rocky soil. (Porter.)

Thuja occidentalis L. Along Lehigh river at Freemansburg; cultivated in yards and cemeteries. June 11, 1900.*

Juniperus virginiana L. On rocky slopes along Monocacy creek.

TYPHACEAE

Typha latifolia L. In marshes along Monocacy creek and along Lehigh canal near Freemansburg. July 26 to Sept. 26, 1895.

Typha angustifolia L. In marshes. (Porter.)

SPARGANIACEAE

Sparganium eurycarpum Engelm. In meadows along Monocacy creek two miles north of Bethlehem. June 23, 1902. (J. A. Ruth.) Along bank of Lehigh river at Island Park, Aug. 25, 1903.

Sparganium androcladum (Engelm.) Morong. In swamps or shallow water. (Porter.)

* This evergreen, reports in various works to the contrary notwithstanding, has yet to be collected as a wild plant in Pennsylvania.—Ed.

NAIADACEAE

POTAMOGETON NATANS L. In Monocacy creek 3 miles from Bethlehem. Aug. 20, 1899.
POTAMOGETON AMPLIFOLIUS Tuckerm. In lakes and ponds. (Porter.)
POTAMOGETON PULCHER Tuckerm. In slow streams or ponds. (Porter.)
POTAMOGETON NUTTALLII Cham. & Sch. In stream at Easton. (Porter.)
POTAMOGETON LONCHITES Tuckerm. In stream at Easton. (Porter.)
POTAMOGETON PERFOLIATUS L. In Delaware river. (Porter.)
POTAMOGETON PERFOLIATUS RICHARDSONII A. Bennett. At Easton. (Porter.)
POTAMOGETON CRISPUS L. In Monocacy creek about 2 miles from Bethlehem, June 23, 1902; also in Lehigh river and Bushkill creek.
POTAMOGETON OBTUSIFOLIUS Mert. & Koch. In stream at Easton. (Porter.)
POTAMOGETON DIVERSIFOLIUS Raf. In still water. (Porter.)
POTAMOGETON DIVERSIFOLIUS MULTIDENTICULATUS Morong. At Easton. (Porter.)
POTAMOGETON PECTINATUS L. In stream at Black Horse Tavern. (Porter.)
POTAMOGETON ROBBINSII Oakes. In Lehigh river.
ZANNICHELLIA PALUSTRIS L. In ponds and ditches. (Porter.)
NAIAS FLEXILIS (Willd.) Rost. & Schmidt. In ponds and streams. (Porter.)

ALISMACEAE

ALISMA PLANTAGO-AQUATICA L. On muddy banks of the Lehigh river near Bethlehem. July 15, 1899.
SAGITTARIA ENGELMANNIANA J. G. Smith. In swamps along Monocacy creek, Aug. 12, 1899, and on mud flats along the Lehigh river at Island Park, Aug. 25, 1902.
SAGITTARIA LATIFOLIA Willd. In shallow water along Monocacy creek and Lehigh river. Aug. 5, 1899.
SAGITTARIA LATIFOLIA PUBESCENS (Muhl.) J. G. Smith. At Seidersville. (Porter.)
SAGITTARIA RIGIDA Pursh. In wet sandy soil along Lehigh river at Island Park. Aug. 25, 1902.
SAGITTARIA GRAMINEA Michx. In shallow water or mud. (Porter.)

VALLISNERIACEAE

PHILOTRIA CANADENSIS (Michx.) Britton. In Lehigh river and Monocacy creek.
VALLISNERIA SPIRALIS L. In the Lehigh canal near Glendon.

GRAMINEAE

ANDROPOGON SCOPARIUS Michx. Along Lehigh Valley R. R. near Bethlehem. Aug., 1899.
ANDROPOGON FURCATUS Muhl. In dry soil along the Monocacy creek one mile from Bethlehem. Aug. 11, 1899.
ANDROPOGON VIRGINICUS L. In sandy soil in thickets, Bethlehem. Aug. 5, 1899.
CHRYSOPOGON AVENACEUS (Michx.) Benth. In dry soil along the towpath between Bethlehem and Freemansburg. Sept. 4.
PASPALUM MUHLENBERGII Nash. In sand or stony ground. (Porter.)
PASPALUM LAEVE Michx. In fields. (Porter.)
SYNTHERISMA SANGUINALE (L.) Dulac. In cultivated and waste places. Common. July 15, 1899.
SYNTHERISMA HUMIFUSUM (Pers.) Rydb. In cultivated field near Bethlehem. Sept. 7, 1899.
ECHINOCLOA CRUS-GALLI (L.) Beauv. Common in cultivated and waste places.
PANICUM CAPILLARE L. In dry soil, in fields and roadsides. Aug. 16, 1899.
PANICUM PHILADELPHICUM Bernh. In dry soil at Bethlehem. Aug. 7, 1899.
PANICUM MILIACEUM L. In waste places. (Porter.)

PANICUM PROLIFERUM Lam. In moist sandy situations, Bethlehem. Aug. 21, 1899.
PANICUM VIRGATUM L. In moist or dry soil. (Porter.)
PANICUM AGROSTOIDES Spreng. In wet grounds. (Porter.)
PANICUM LONGIFOLIUM Torr. In wet ground along towpath between Bethlehem and Freemansburg. Sept. 4, 1899.
PANICUM STIPITATUM Nash. In moist soil. (Porter.)
PANICUM ANCEPS Michx. In wet or moist ground along towpath near Freemansburg; and along Saucon creek 1½ miles from its mouth. Sept. 4, 1899.
PANICUM LINEARIFOLIUM Scribn. In dry soil, especially on hillsides. (Porter.)
PANICUM DEPAUPERATUM Muhl. In dry soil on hillsides with northern exposure near South Bethlehem. May 20, 1899.
PANICUM DICHOTOMUM L. On shaded hillsides, Lehigh Mt.
PANICUM BARBULATUM Michx. In moist soil. (Porter.)
PANICUM BOREALE Nash. In moist soil. (Porter.)
PANICUM NITIDUM Lam. In woods, Lehigh Mt.
PANICUM IMPLICATUM Scribn. In dry soil. (Porter.)
PANICUM UNCIPHYLLUM Trin. In dry soil. (Porter.)
PANICUM ATLANTICUM Nash. In dry soil. (Porter.)
PANICUM TENNESSEENSE Ashe. In woods. (Porter.)
PANICUM SCRIBNERIANUM Nash. In dry or moist soil at Easton. (Porter.)
PANICUM SPHAEROCARPON Ell. In dry soil. (Porter.)
PANICUM COMMUTATUM Schultes. In dry woods and thickets. (Porter.)
PANICUM MACROCARPON Le Conte. In moist places. (Porter.)
PANICUM PORTERIANUM Nash. In woods on Lehigh Mt. south of Lehigh University. June 15, 1900. (J. A. Ruth.)
PANICUM PUBIFOLIUM Nash. In rocky woods. (Porter.)
PANICUM CLANDESTINUM L. In thickets near Bethlehem. July 29, 1899.
CHAETOCHLOA GLAUCA (L.) Scrib. In waste places and cultivated grounds. Common.
CHAETOCHLOA VERTICILLATA (L.) Scrib. In waste places. Aug. 9, 1899. Bethlehem.
CHAETOCHLOA VIRIDIS (L.) Scrib. In waste places and cultivated grounds about Bethlehem.
CHAETOCHLOA ITALICA (L.) Scrib. Occasionally in waste places.
CENCHRUS TRIBULOIDES L. In dry soil along towpath near Bethlehem. Aug. 22, 1899.
HOMALOCENCHRUS VIRGINICUS (Willd.) Britton. In wet soil along Lehigh River near Bethlehem. Aug. 5, 1899.
HOMALOCENCHRUS ORYZOIDES (L.) Poll. In moist soil along Monocacy creek, Bethlehem. Sept. 3, 1899.
PHALARIS ARUNDINACEA L. In meadows along Monocacy creek, Bethlehem. June 11, 1900.
PHALARIS CANARIENSIS L. In dry soil along towpath near Bethlehem. July, 1902. (J. A. Ruth.)
ANTHOXANTHUM ODORATUM L. Common in dry soil on Lehigh Mt. near Lehigh University. May 20, 1899.
ARISTIDA DICHOTOMA Michx. In woods on Lehigh Mt. Sept., 1899.
ARISTIDA GRACILIS Ell. In dry soil. (Porter.)
ARISTIDA PURPURASCENS Poir. In dry soil. (Porter.)
MUHLENBERGIA SOBOLIFERA (Muhl.) Trin. In dry rocky woods one mile east of Bethlehem. Sept. 4, 1899. Altitude 360 feet.
MUHLENBERGIA MEXICANA (L.) Trin. In fields and hedges, Bethlehem. Sept. 16, 1899. Altitude 350 feet.
MUHLENBERGIA SYLVATICA Torr. In moist woods and along streams. (Porter.)
MUHLENBERGIA TENUIFLORA (Willd.) B.S.P. In rocky woods. (Porter.)
MUHLENBERGIA DIFFUSA Schreb. Along roadsides, Bethlehem. Sept. 16, 1899.
BRACHYELYTRUM ERECTUM (Schreb.) Beauv. In moist places or woods. (Porter.)

PHLEUM PRATENSE L. Common in fields.
SPOROBOLUS LONGIFOLIUS (Torr.) Wood. In dry soil. (Porter.)
CINNA ARUNDINACEA L. In moist woods and swamps. (Porter.)
AGROSTIS ALBA L. In cultivated fields. Common.
AGROSTIS PERENNANS (Walt.) Tuckerm. In moist soil along canal near Bethlehem. Aug. 20, 1899.
AGROSTIS CANINA L. In meadows along Delaware river above Easton. (Porter.)
AGROSTIS HYEMALIS (Walt.) B.S.P. In dry or moist soil. (Porter.)
AGROSTIS SCRIBNERIANA Nash. In dry soil. (Porter.)
CALAMAGROSTIS CANADENSIS (Michx.) Beauv. In swamps and wet, often sandy, soil. (Porter.)
HOLCUS LANATUS L. In meadows along Monocacy creek near Bethlehem. May 30, 1900.
AIRA PRAECOX L. In dry fields, Bethlehem. (Porter.)
DESCHAMPSIA FLEXUOSA (L.) Trin. In dry, sandy soil. (Porter.)
TRISETUM PENNSYLVALICUM (L.) Beauv. In a ravine, Lehigh Mt., near Lehigh University. June 15, 1900. (J. A. Ruth.)
AVENA SATIVA L. Cultivated and in waste places.
ARRHENATHERUM ELATIUS (L.) Beauv. In fields and waste places. (Porter.)
DANTHONIA SPICATA (L.) Beauv. In dry soil. (Porter.)
DANTHONIA COMPRESSA Austin. In woods, Lehigh Mt. July 1, 1899. (J. A. Ruth.)
CAPRIOLA DACTYLON (L.) Kuntze. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Torrey Bulletin Jan., 1892. (Porter.)
BOUTELOUA CURTIPENDULA (Michx.) Torr. In rocky woods one mile east of Bethlehem. Sept. 4, 1899. Altitude 360 feet.
ELEUSINE INDICA (L.) Gaertn. Along roadsides and waste places, Bethlehem. Aug. 5, 1899.
SIEGLINGIA SESLERIOIDES (Michx.) Scribn. In sandy soil along towpath east of Bethlehem. Aug. 5, 1899.
ERAGROSTIS CAPILLARIS (L.) Nees. In dry soil at Bethlehem. Aug. 7, 1899.
ERAGROSTIS FRANKII Steud. Along Delaware River above Easton. (Porter.) In fields and along roadsides, Bethlehem.
ERAGROSTIS PURSHII Schrad. At Easton. (Porter.) Along railroad tracks east of Bethlehem, and in dry soil along roadside. Aug. 5, 1899.
ERAGROSTIS MAJOR Host. In dry soil. Bethlehem. Aug. 9, 1899.
ERAGROSTIS PECTINACEA (Michx.) Steud. Common in waste places at Bethlehem. Aug. 5, 1899.
ERAGROSTIS HYPNOIDES (Lam.) B.S.P. On sandy shore of Lehigh river at Bethlehem; also on Calypso Island. Aug. 22, 1899.
EATONIA PENNSYLVANICA (DC.) A. Gray. In moist shady places along bank of Lehigh river one mile east of Bethlehem. June 3, 1899.
EATONIA NITIDA (Spreng.) Nash. In dry woods. (Porter.)
DACTYLIS GLOMERATA L. In fields and waste places. Very common.
POA ANNUA L. Common in fields and waste places.
POA COMPRESSA L. Common in fields and waste places.
POA PRATENSIS L. In fields and meadows. Common.
POA TRIVIALIS L. In meadows at Bethlehem. June 11, 1900. (J. A. Ruth.)
POA FLAVA L. In swampy places. (Porter.)
POA BREVIFOLIA Muhl. In rocky woods. (Porter.)
PANICULARIA NERVATA (Willd.) Kuntze. In moist soil along canal, Bethlehem. June 20, 1899.
PANICULARIA AMERICANA (Torr.) MacM. In moist soil, South Bethlehem.
PANICULARIA PALLIDA (Torr.) Kuntze. In shallow water. (Porter.)
PANICULARIA FLUITANS (L.) Kuntze. In swamps, wet places or in water. (Porter.)
FESTUCA OCTOFLORA Walt. In fields and waste places. (Porter.)
FESTUCA OVINA DURIUSCULA (L.) Hack. In dry soil. (Porter.)
FESTUCA ELATIOR L. In fields and waste places. (Porter.)

Festuca nutans Willd. In woods on Lehigh Mt. July 1, 1899. (J. A. Ruth.)
Bromus ciliatus L. In woods and moist thickets. (Porter.)
Bromus tectorum L. In streets of Easton. (Porter.)
Bromus sterilis L. In waste places, Easton. (Porter.)
Bromus Kalmii A. Gray. In moist woods and thickets. (Porter.)
Bromus secalinus L. In waste places and roadsides at Bethlehem. June 25, 1902.
Bromus racemosus L. In waste places and in dry soil at Bethlehem. May 23, 1899.
Lolium perenne L. Along roadsides and in waste places, Bethlehem. July 10, 1899.
Lolium temulentum L. In waste and cultivated grounds. (Porter.)
Agropyron repens (L.) Beauv. Around stables and in waste places, Bethlehem. June 21, 1899.
Elymus striatus Willd. In woods and on banks, Easton. (Porter.)
Elymus virginicus L. In moist sandy soil along Lehigh river near Bethlehem. Aug. 22, 1899.
Elymus canadensis L. In moist sandy soil along towpath east of Bethlehem. Aug. 5, 1899.
Hystrix Hystrix (L.) Millsp. In shady places along Saucon creek ½ mile from its mouth. Sept. 4, 1900.

(*To be continued*)

SOME RARE OHIO PLANTS FROM ASHTABULA COUNTY, OHIO

By Otto E. Jennings

During the latter part of the summer there came to me an inquiry from my friend Mr. Robert J. Sim regarding the possible occurrence of the rare orchid, *Tipularia discolor* (Pursh) Nuttall, in Ashtabula County, Ohio. A doubt having been expressed that the orchid would be found that far north, Mr. Sim expressed his firm belief in the correctness of his record and, later in the season, October 5, 1911, sent in to the Carnegie Museum several fine specimens of the plants, one of the plants still retaining the dead flower-stalk and seed-pods. Part of these plants were pressed and entered in the Herbarium of the Carnegie Museum, and part of them planted on the grounds of Dr. J. F. Shafer, the Pittsburgh orchid specialist. Accompanying the plants came from Mr. Sim a pencil sketch of flowers bearing the legend "Aug. 1, 1903, Andrew's Wood. 4 or 5 plants found. Jefferson, O.," and also a sketch done in color showing the single erect leaves, beautifully purplish dorsally. The color sketch bore the label "Andrews' Wood, Oct. 22, 1903. Jefferson, Ohio."

That Mr. Sim's station for *Tipularia* is a notable one appears at once from an examination of the areas of distribution accorded the species in the manuals. Britton's Manual, 2d edit., 1905, says: "In woods, Vt. to Mich., south to Fla. and La. Local and rare." Gray's Manual, 7th edit., 1908, restricts the range, thus: "A southern species, extending northw. to N. J.; reported but unverified from farther north." In the Emendations to the

FIG. I. The Crane-Fly Orchis (*Tipularia discolor*) as sketched from nature by Mr. R. J. Sim. Found growing in "Andrew's Wood," near Jefferson, Ashtabula County, Ohio; flowers, August 1, 1903; leaves, October 22, 1903.

Seventh Edition of Gray's Manual.—I. Robinson and Fernald, Rhodora **11**: 33–61. March, 1909, the data of distribution were again changed to "Woods, N. J. and e. Pa. to Fla. and La.; also Cuyahoga Co., O. (Bassett)." Regarding the localities recorded in eastern Pennsylvania, the present writer finds records of occurrence in only the extreme southeastern corner of the

state, Delaware County; while for New Jersey the record is for Gloucester County, south of Philadelphia, and Cape May County in the extreme southern end of the state.

In the light of the data given above it appears that the emendations to the last Gray's Manual would give to Ohio the honor of "farthest north" in the distribution of *Tipularia* and a glance at the map shows that the new station at Jefferson, Ohio, marks the extreme northern limit in the known distribution of the orchid. This last station is considerably farther north than either of the Ohio stations previously reported—Lorain and Cuyahoga Counties—Ohio Naturalist, **10**: 34. December, 1909.

In the latter part of August (1911) the writer had the pleasure of being guided by Mr. Sim up the gorge of Ashtabula Creek for perhaps two miles above the town of Ashtabula. To a naturalist this is a delightful place, abounding in insects and plants, and in the soft shales of the perpendicular bluffs bounding the gorge on either side are excellent brachiopods and cone-in-cone structures. Mr. Sim pointed out some large patches of *Tussilago Farfara* L. growing vigorously on the damp talus at the base of the bluff along the stream. This species is an interesting example of the spread of an introduced plant, it now being found in the East from Philadelphia to eastern Quebec and in various places along the Great Lakes to Minnesota. It occurs in several places near Erie, Pennsylvania; and besides Ashtabula County it has been reported in at least two other lake counties of Ohio,—Cuyahoga and Lake.

In places along Ashtabula Creek the shaly bluffs rise almost perpendicularly to a height of perhaps one hundred and twenty-five feet; and here and there have a more or less well-developed forest-covering, which might be designated as a hemlock-birch association, with also much of the white pine and mountain maple (*Acer spicatum*). The birch has proved to be interesting, as approaching pretty closely the typical form of *Betula lutea* Michx. f., but yet differing in several points. The leaves are quite typically those of *B. lutea* in the subcordate form, quite pubescent beneath and with a larger number of veins than in *B. lenta;* the bark is yellowish and peels off in thin layers; the

pistillate aments are nearly sessile, oblong, up to 3 cm. long; the bracts are pubescent, marginally ciliate, divided about to the middle into three equal lobes which diverge rather widely, the mature bracts reaching usually about 1 cm. long by 1 cm. wide and the angle formed at the base of the bract by the almost straight sides being practically a right angle; and the nut is narrowly obovate and slightly wider than the wing. In the rather constantly subcordate base of the leaves and in the more widely diverging lobes of the fruiting scales the Ashtabula specimens suggest a tendency towards the *Betula alleghanensis* of Britton, and it is not improbable that more typical specimens of this latter *Betula* might be found in the Ashtabula corner of Ohio.

Carnegie Museum,
November 30, 1911

SOME MODERN TRENDS IN ECOLOGY

By Norman Taylor

When Ernst Haeckel, in 1866, first used the term *ecology*, it is safe to say that he little realized how the word would ultimately be construed to cover a very different set of biological factors from those described by him. Not only has the word *ecology* had a somewhat checkered career, having to stand as the outward and visible sign of many phases of biological activity, but it seems quite likely that a rather large section of that science which deals with organisms in their relation to environment has wrongfully appropriated this much used and sadly misunderstood word.

Let us hastily review the use of it by the chief exponents of what is just now a very important feature of botanical literature. While it has been stated that Haeckel first coined the term, the principles underlying the concept of ecology are very ancient. Without unearthing the more or less apocryphal progenitors of the idea, one distinguished figure of the last century stands out with whom we must reckon. Writing in 1836 Meyen has this to say: "The station (ecology) of plants denotes the relation in which the plants stand to the situation in which they always

grow." This master in the study of plant geography recognizes, but does not specifically define, ecology. The passage quoted above is the epitome of Meyen's idea of ecology, and his treatment of it is mostly physiographic and edaphic. He thinks and writes of plant ecology in terms denoting unmistakably that the relation of plants *en masse* to their environment is, to him, the crux of the question.

Warming, the father of modern plant ecology, delimited the concept thus, in 1895: Ecology "teaches us how plants or plant communities adjust their forms and modes of behavior to actually operating factors, such as the amounts of available water, heat, light, nutriment, and so forth." This landmark in the development of the science is almost exclusively physiographic in its scope, and throughout it is the relation of plants *en masse*, and plant communities, to their environment that is considered fundamental. That these "actually operating factors" must, of course, operate on individuals, in order to have the least effect upon the distribution of collections of plants, was fully recognized by the author.

He did not, however, consider these purely physiologic and morphologic adaptations of individuals as the principal feature of ecology, for his book is mainly a descriptive study of vegetation.

In this country, one of the first to use the term and the first to make a serious contribution to the science, was MacMillan. During 1897, in his Minnesota Botanical Studies, which were wholly physiographic in character, he says: "That branch of biology which concerns itself with the adaptation of organisms to their surroundings, is . . . termed ecology." His Metaspermae of the Minnesota Valley marks the beginning of a voluminous literature of a distinctly ecological trend, notwithstanding the fact that this particular work was phytogeographical, which is quite another thing. That MacMillan, in most of his writings, was an ecological plant geographer and that the distribution of plants *en masse* was the chief interest with him, is the only conclusion that forces itself on his numerous readers.

We have, then, still with us in 1897, the word *ecology*, which, if not actually, had by usage become a symbol of a rather definite idea, almost exclusively physiographic in scope.

Omitting the several hundred papers of varied size and begotten of various concepts of the science, let us quote another figure of prominence in the field. Coulter, in his Plant Structures (1900), defines the field of ecology thus: "It treats of the adjustments of plants *and their organs* to their physical surroundings, and also their relations with one another and with animals, and has sometimes been called 'plant sociology.'" The italics are mine. While this was not the genesis of a new phase of ecology, it was at least one of the first prominent expositions of the indisputable fact that adjustments of plants and plant communities to their environment must, in the last analysis, rest upon the adjustment of the organs of individual plants to external influences. It is merely an elaboration of the fact noted by Warming in 1895, that the distribution of plants must be correlated with the adjustment of the individual plant. That plant communities depend for their existence upon the community of response in the organs of individuals of the society or association, seems so self evident, that it is strange the idea was not very strongly exploited before the passage quoted above was written. We see here one of the first extensions of the concept of *ecology* to cover a new set of activities, a partial transference of the idea from plants to their organs. This addition, while not revolutionary, is significant, and hereafter we find a broader note throughout ecological literature. Some of Coulter's writings have been "ecology" of the old order, although he seems to be one of the first figures of prominence to draw attention to the individualistic and functional phase of the science.

From 1900 until 1905 the number of ecological papers published was enormous and much of it was the descriptive study of vegetation. But mark how the best known exponent of the plant association-idea limits his definition of the science in his Research Methods in Ecology (1905): "The clue to the field of ecology is found in the Greek word *οἶκος*, home. [It] . . . has been largely the descriptive study of vegetation; physiology has concerned itself with function; but, when carefully analyzed, both are seen to rest upon the same foundation." Notwithstanding the last part of this statement, most of the ecological writing of

Professor Clements has been the descriptive study of vegetation. All but sixty pages of the work just cited are devoted to phases other than the functional side of ecology.

From the time of this work until the present, most of the men engaged in ecological work have laid more emphasis upon the physiographic side of the subject than upon the individual response of plant organs. Transeau, Shreve, Clements, Gleason, R. M. Harper, Spalding, Harshberger, Drude, and Cowles, to mention only a few, have written papers which, in the main, discussed the physiographic features of the science.

It would be unfair to those mentioned above to infer that they have ignored the question of the individual response of plant organs to environmental factors as being the controlling agency in the occurrence of plant communities. But it may be said, with a large measure of truth, that most of them while thoroughly realizing the fundamental nature of this proposition, have seen fit to lay stress rather upon the physiographic problems than upon those of functional and individual adaptations.

In other words, the term *ecology* has grown enormously in significance since the time of 1897. It has so broadened its scope that to-day one of the chief American exponents of the science not only maintains that the physiologic and morphologic response of plant organs are the main features of ecology, but unlike most of his predecessors, he devotes nine tenths of his book to these phases of the subject. Professor Cowles, in the introduction to his new text book,* has this to say, in explaining the change of emphasis: "Plant ecology has a two-fold aspect: the one considers the individual organism and its component parts as related to environment; this, since it overlaps morphology and physiology may be called *morphological and physiological ecology*, or the ecology of plant structure and behavior. The other aspect considers plants *en masse* as related to soil and climate; this, since it overlaps physiography, may be called *physiographic ecology*, or the ecology of vegetation."

Less than ten pages of the present work are devoted to plant

* Coulter, J. M., Barnes, C. R., and Cowles, H. C., A Textbook of Botany for Colleges and Universities, Vol. II, Ecology, pp. i–x + 485–964, figs. 700–1234. American Book Co., N. Y. $2.00. [December, 1911.]

associations and related phases of the subject, and all the rest of the book deals with the morphologic and physiologic home-economy of plant organs and behavior. This, to quote the preface, has been done "to develop certain general conceptions that are felt to be fundamental." It should be stated, however, that the work is not for professional ecologists.

Within the limits of Professor Cowles' restrictions, it would be difficult to imagine a more complete or satisfactory treatment of the underlying foundations of ecology. Roots and rhizomes are first discussed in their relation to absorptive, anchoring and propping functions. Under "root hairs" there is a long discussion of different soil constituents, bog water, salts of various kinds, and so forth, and the effect these have on plants. Soil exhaustion and its relation to deleterious root excretion is also discussed.

In the long chapter on the ecology of leaves, the first part is given over to the discussion of chlorophyll and food manufacture, and later the structure and arrangement of chlorenchyma is presented. "The Relation of Leaves to Light," "Air Chambers and Stomata," "Protection from Excessive Evaporation," "Variations in Leaf-form," "Absorption of Water and Non-gaseous Solutes of Leaves," "Leaves as Organs of Secretion and Excretion," "Leaves as Organs of Accumulation of Water and Food," and "Miscellaneous Leaf Structures and Relations," are all sections of this chapter and will give the reader an idea of the scope of the work.

Lack of space forbids discussion of the subjects presented in this chapter, but it may be questioned by some whether the sparse undergrowth of hemlock forests is mostly a matter of shade (p. 546); for is it not related also to the excessive amount of tannic acid leached from the trunk and branches during rains, and perhaps also in part to toxicity of the decayed leaves of the hemlock?

In the chapter devoted to stems, a large variety of subjects are discussed, such as stems as organs of display, reproductive organs, conductive and mechanical tissue, and the accumulation of food and water in stems. All the features of ecological significance are treated in detail and with a thoroughness that should

set an ideal for all users of the book. On page 708 the statement that "alligator" bark is caused by the division of the bark into blocks of somewhat equidistant transverse and longitudinal furrows may excite some comment. It is quite certain that the peculiar bark feature there described may be characterized by such furrows, but hardly *caused* by them. This touches closely the question of anthropomorphism, which while specifically disavowed by Professor Cowles, is nevertheless a common form of expression throughout the book. Without a skillfully devised and obviously clumsy form of expression, it is almost impossible to write of the ecological factors of plant economy without drifting into a more or less anthropomorphic style.

It may be truthfully stated that no recent text book has given such a thoroughly satisfactory treatment of saprophytism and symbiosis in so far as these subjects deal with ecological problems, as the one at hand. The principles underlying the functional activity of plants wholly autophytic and those "whose existence depends upon antecedent or coexistent organic forms," must be recognized by those who study the habits and environmental necessities of plants. Furthermore, the practical bearing of the subject is limitless, as the cultivation of crops and of thousands of individual plants can only be successfully accomplished by a thorough understanding of this perplexing relation of one plant upon another, and by the application of these principles to horticultural and agricultural practice. In the section dealing with parasitism there is a discussion of grafting and the influence of stock and scion upon each other. The formation of galls, nitrogen-fixing bacteria, and the mycorhizal problem, together with the nature of lichen symbiosis, are also fully discussed.

More than one hundred pages are given over to reproduction and dispersal, both in the so-called seedless plants and in the Spermatophyta. Among the latter, particular attention is drawn to the modes of pollination by wind and water, and a long discussion of insect pollination deals with this important branch of ecology. This, almost exclusively, deals with the intricate methods of pollination in various types of flowers and by various

types of insects, scarcely at all with the ultimate effects of these operations. This point of view, however, colors the whole tone of the book, as one might expect from the exposition quoted above. It is not the effects upon the distribution of plants that it is aimed to present, so much as the individual response of the organs of plants to external environmental factors. It may be questioned by some, that in view of the distributional phase of ecology which has hitherto appropriated so much attention, it should not have received more notice from the author of the present work. That it has not indicates, at least, a significant trend in modern ecology.

After a short chapter on germination in its relation to ecological problems, Professor Cowles takes up the much discussed and perhaps much overdone question of "Plant Associations." As an antidote for the association-idea run riot, to which we have unfortunately become accustomed, this chapter is the most effective imaginable. Coming as it does from an authoritative American ecologist, it should serve to check those who have written as though the minute description of somewhat similarly constituted vegetation areas, was the end and aim of ecology. One very necessary concomitant of the study of plant associations, Dr. Cowles has probably intentionally omitted, perhaps because the book was intended for undergraduate use. But it seems doubtful if one can intelligently study the associations of plants, without taking into account the ancestral history of the species or genera under consideration. This, of course, involves larger problems of geographical distribution, center and periphery of distributional frequency, climatic factors, and the geological history of the area treated.

In bringing to a close this somewhat brief outline of this work, scholarly in its treatment, broad in its outline and comprehensive in its ideas as to the fundamentals of plant ecology, as the author has by his treatment conceived that science, it is a pleasure to record the fact that it will undoubtedly be a standard book on the subject for years to come. A bibliography and an index complete the usefulness of the work for the student. I have found only a single error of fact, on page 495, where the wholly marine *Zostera* is stated to be a salt marsh plant.

Some there are who will feel that the evolution of the ecology-idea has changed, become more individualistic and narrow, less communistic and "broad." For such the present book will not be "ecology" at all, but a study of the response of plant individuals and their organs to external influences. That such response is the fundamental and penultimate basis of ecology all will agree, but that it is the superstructure and ultimate aim of the science some will doubt. But "ecologists are not agreed even as to fundamental principles and motives, indeed no one, . . . least of all the present speaker, is prepared to define or delimit ecology." Warming did not say this, nor Clements, but Henry Chandler Cowles said it as late as 1904.*

BROOKLYN BOTANIC GARDEN

PROCEEDINGS OF THE CLUB

FEBRUARY 28, 1912

The meeting of February 28, 1912, was held in the Museum Building of the New York Botanical Garden, 4 P.M., Vice-President Barnhart presiding. Fifteen persons were present.

The minutes of the meetings of January 31 and February 13 were read and approved.

Dr. Marshall A. Howe, Secretary of the Board of Editors, presented the following proposed agreement between the Torrey Botanical Club and Columbia University:

With a view to enlarging the Library resources of the Department of Botany of Columbia University and of the Torrey Botanical Club, the following AGREEMENT BETWEEN THE TORREY BOTANICAL CLUB AND COLUMBIA UNIVERSITY WAS ENTERED INTO.

It is hereby agreed by Columbia University that it will provide for the storage of the publications of the Torrey Botanical Club; and that it will bind, catalogue and make accessible the periodicals received by it in exchange for the publications distributed in the manner below described.

It is also agreed that members of the Torrey Botanical Club

* Science II. **19**: 879. Je 1904.

shall have equal rights with members of the Columbia University in the use not only of the publications thus acquired by exchange. but of all books in the library of the Department of Botany.

The Torrey Botanical Club, on its part, agrees in consideration of the privileges thus secured and the expense thus incurred by the University to transfer to the University the Property in all publications hereafter received by the University in exchange for publications of the Club.

All details relating to exchanges, subject to the resolution of the Board of Editors of the Torrey Botanical Club, hereto attached and made part of this agreement, shall be delegated to a Committee consisting of the Librarian of Columbia University and the Librarian of the New York Botanical Garden and for this purpose said librarians are hereby made *ex-officio* members of the Club, with exemption from payment of the annual dues. This Committee shall make an annual report to the Board of Editors.

(Resolutions of the Board of Editors):

1. The surplus stock of the *Bulletin of the Torrey Botanical Club* may be used for exchanges, beginning Volume 26 (1899), provided that a minimum of 50 complete sets, beginning with this date, is reserved for sale by the Club.

2. The surplus stock of TORREYA may be used for exchanges, beginning with Volume 1 (1901) provided that a minimum of 100 complete sets is reserved for sale by the Club.

3. The surplus stock of the *Memoirs of the Torrey Botanical Club* is not to be used for exchanges.

4. All exchange publications intended for use at Columbia University are to be addressed to the Torrey Botanical Club, Columbia University. Those intended for use at the Botanical Garden are to be addressed to the Torrey Botanical Club, New York Botanical Garden.

The above agreement may be terminated at the option of either of the parties thereto on six months' notice.

On motion the agreement was unanimously adopted and the President was authorized to sign the agreement on behalf of the Club.

Dr. C. Stuart Gager was elected Delegate to represent the Torrey Club at the centenary anniversary of the Academy of Natural Sciences of Philadelphia, March nineteenth, twentieth and twenty-first.

The resignations of Miss Louise H. Seely, Edwyn Waller, Leon L. Cypress, H. Dautun and Edwin C. Bolles were read and accepted. The lecture on "Agricultural Information for City People" was postponed on account of the unavoidable absence of Prof. O. S. Morgan.

Dr. C. A. Darling of Columbia University presented a paper on "The Determination of Woods." The speaker exhibited specimens of about forty different kinds of woods and outlined a method by which the identity of a piece of wood may be determined with the aid of a hand lens.

Meeting adjourned.

B. O. Dodge, *Secretary*

March 12, 1912

The meeting of March 12, 1912, was held at the American Museum of Natural History at 8:15 P.M. The meeting was called to order by Dr. Z. L. Leonard in the absence of officers of the Club. Mr. Sereno Stetson was appointed Secretary pro tem. Twenty-five persons were present.

The paper of the evening consisted of an illustrated lecture by Dr. Marshall A. Howe on "Some Floral and Scenic Features of Cuba." Lantern-slide photographs were shown illustrating characteristic Cuban plant associations, particularly in the provinces of Oriente, Camagüey, Matanzas, and Pinar del Rio. Special attention was given to the numerous native palms of the island and to the cacti of the Guantanamo Bay region. The sugar, tobacco, and fruit-growing industries of Cuba were also illustrated and commented upon.

Meeting adjourned.

Sereno Stetson, *Sec. pro tem.*

NEWS ITEMS

Professor Bruce Fink, of Miami University, Oxford, Ohio, desires to see fresh material in abundance of species of the Collemaceae collected in various parts of New York State. This group of lichens is greatly in need of careful modern taxonomic treatment and Professor Fink will devote much of his time to it during the next two years.

We learn through the daily press that the executive committee of the corporation of Brown University has decided to erect a greenhouse adjoining Maxcy Hall, as an extension of the botanical laboratory. The library has received a gift of 150 volumes of rare botanical books, valued at $2,000, in memory of the late Edward P. Taft, class of '54.

The natural history library of the University of Illinois has been enriched by the addition of a set of Flora Brasiliensis, in forty folio volumes and costing $1,500. The set is written in Latin and is said to be the fourth obtained by American libraries, others being at Harvard, Columbia and the Shaw Botanical Gardens.

Dr. J. N. Rose, who has recently been appointed research associate in the Department of Botanical Research of the Carnegie Institution, sailed for Europe on April 17, where he goes to investigate cactus collections in the various botanical gardens of England, France, Italy and Germany. He will be away about two months. His European address will be: Royal Botanic Gardens, Kew, London, England.

Dr. N. L. Britton, of the New York Botanical Garden, has returned from explorations in eastern Cuba, with more than 2,300 specimens, including many cacti and cycads.

TORREYA

June, 1912

Vol. 12 No. 6

INDUCED HERMAPHRODISM IN ACER NEGUNDO L.

By Charles Gordon Fraser

In the sixth edition of Gray's Manual the ash-leaved maple or box elder is classified as *Negundo Aceroides* Moench., in a separate genus following the genus *Acer*. The first and one of the chief distinctions made is that the genus *Acer* is polygamo-dioecious, whereas *Negundo* is dioecious. Sargent (1905) makes the same distinction, describing *Negundo* as: "Staminate and pistillate on separate trees, . . . (stamens) none in the pistillate flower." In the seventh—and latest—edition of Gray's Manual this species is given the classification *Acer Negundo* L., but is placed in a second sub-division of the genus which is characterized as "*strictly dioecious*." Britton (1908) classifies this form as *Acer Negundo* L., with the synonym *Negundo Aceroides* Moench., and description: "Staminate and pistillate flowers on different trees."

On May 15, 1909, the writer came across an exception to the strict dioeciousness of *A. Negundo*. By the banks of a creek near Weston, Ontario, in a grove of this species, a tree was found on one limb of which hermaphrodite flowers were borne in considerable numbers. For at least four years previous, as could readily be determined by the winter bud scars, and the *persistent pedicels*, the tree had fruited copiously, this particular limb not excepted. On the main part of the tree, which was searched carefully, only normal pistillate flowers were found. By some accident the limb in question had been partly split from the trunk, in such a way as to leave about one fifth of its bark and cambium intact. Fig. 1 shows the general appearance of the tree with the partly detached branch; fig. 2 indicates the

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FIG. 1. Hermaphrodism in *Acer Negundo* L.
See descriptions of figures in text.

nature and extent of the wound. In 1910 all the other branches bore fruit as usual, but this limb produced a comparatively small crop of seeds, and these of a poor quality. The winter buds in the spring of 1910 did not appear vigorous, but the writer had no opportunity of examining the flowers or the fruit during that season, nor in the spring of 1911. This winter, however, a fair crop of seed was found on the branch.

Besides having both stamens and carpels the flowers of this branch deviated from the normal types in other respects. Of these types Sargent says: "Staminate fascicled on slender hairy pedicels, $1\frac{1}{2}'$–$2'$ long, the pistillate in narrow drooping racemes; calyx campanulate in the staminate, much smaller in the pistillate flower." Britton states that "the staminate ones are on hairy drooping pedicels, have a 5-lobed calyx, and about 5 stamens, with long pointed anthers much projecting beyond it; the pistillate flowers are in smooth or hairy drooping racemes, which greatly elongate as the fruit matures, have 5 linear oblong sepals, a slightly hairy ovary, two slender styles, and no stamens." Figs. 3 and 4 illustrate the normal male and female inflorescences respectively. In fig. 5 a hermaphrodite spray is shown from the injured branch at the same magnification as figs. 3 and 4, while the same spray appears at a higher magnification in fig. 6. The inflorescence represented in the latter figure resembles the drooping raceme of the normal carpellate more than the fascicle of the normal staminate. The structure of the flowers, moreover, is different from the two ordinary types. The calyces resemble the larger and more campanulate calyces of the staminate flowers; but in their deep lobing they are more like those of the pistillate. Finally, the normal number of stamens is given by Gray as *4–5*, by Sargent as *4–6*, and by Britton as *about 5*. The number of stamens in the flowers shown in fig. 6 varies from 0–5, the commonest numbers being 3 and 4. These hermaphrodite flowers, then, in respect to the character of the inflorescence, the structure of the calyces, and the number of the stamens, are intermediate between the normal dioecious types.

The condition described is evidently teratological, but since wounding is known in many cases to cause reversion to a more

primitive type of structure,* it suggests that *Negundo* in its origin has a very close relationship to the genus *Acer*—probably a highly specialized form in this genus. In this connection the simpler, more *Acer-like* foliage of the seedling of *A. Negundo* is to be recalled. This phenomenon and the occurrence of the hermaphrodite flowers above recorded lends support to the classification which places *Negundo* in the genus *Acer*.

In conclusion I wish to express my heartiest thanks to Mr. R. B. Thomson for his interest and assistance in the preparation of this paper.

University of Toronto,
February, 1912

References

Britton, N. L., North American Trees, New York, 1908.

Sargent, C. S., Manual of the Trees of North America, Boston and New York, 1905.

THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Wilbur L. King

(*Continued from May Torreya*)

CYPERACEAE

Cyperus flavescens L. In marshy grounds, Easton. (Porter.)

Cyperus rivularis Kunth. At Island Park. (Porter); in wet soil along canal at Bethlehem. Sept. 1, 1899.

Cyperus inflexus Muhl. In wet, sandy soil. (Porter.)

Cyperus dentatus Torr. Along canal in wet sandy soil at Bethlehem, Sept., 1898. Specimens with flower scales modified into tufts of small leaves have been found.

Cyperus rotundus L. On ore dumps in Bethlehem Steel Co.'s yard. Reported in Torrey Bulletin Jan., 1892.

Cyperus esculentus L. In wet soil and in meadows along Monocacy creek near Bethlehem. Common. Aug. 5, 1899.

Cyperus strigosus L. In moist sandy soil and in meadows at Bethlehem. Sept. 9, 1896.

Cyperus filiculmis Vahl. Along Lehigh river. (J. A. Ruth.)

Dulichium arundinaceum (L.) Britton. In moist soil at Island Park. Aug. 25, 1902.

Eleocharis ovata (Roth.) R. & S. On muddy shores of Lehigh river at Bethlehem.

Eleocharis glaucescens (Willd.) Schult. In moist soil along Lehigh canal at Bethlehem. June 20, 1899.

Eleocharis acicularis (L.) R. & S. On muddy banks of Lehigh river, Bethlehem. Aug. 22, 1899.

* In certain acacias, pines, junipers, etc., wounding causes reversion to the seedling type of foliage which is considered ancestral.

Eleocharis intermedia (Muhl.) Schultes. In wet soil along Monocacy creek 1 mile east of Bethlehem. Sept. 24, 1904.
Stenophyllus capillaris (L.) Britton. In dry or moist soil. (Porter.)
Fimbristylis autumnalis (L.) R. & S. In moist sandy soil along Lehigh river, Bethlehem. Aug. 22, 1899.
Scirpus planifolius Muhl. In woods, Lehigh Mt. May 13, 1899.
Scirpus debilis Pursh. In sandy soil along Lehigh river, Bethlehem. Aug. 22, 1899.
Scirpus americanus Pers. In fresh water and brackish swamps. (Porter.)
Scirpus lacustris L. In wet sandy soil at Bethlehem. Aug. 5, 1899.
Scirpus atrovirens Muhl. In meadows along Monocacy creek one mile from Bethlehem. July 28, 1900.
Scirpus cyperinus (L.) Kunth. In swamps or meadows. (Porter.)
Eriophorum gracile Koch. In bogs and ponds. (Porter.)
Scleria pauciflora Muhl. In dry soil. (Porter.)
Carex folliculata L. In shaded swamps and wet woods, Pen Argyl. (Porter.)
Carex intumescens Rudge. In damp thickets and wet places. (Porter.)
Carex lupulina Muhl. In swamps. (Porter.)
Carex lurida Wahl. In wet places. (Porter.)
Carex hystricina Muhl. At Easton. (Porter.) In wet meadows along Monocacy creek near Bethlehem. May 27, 1899.
Carex comosa Boott. Near Easton. (Porter.) In wet soil along Monocacy creek near Bethlehem. May 30, 1899.
Carex trichocarpa Muhl. In wet places. (Porter.)
Carex scabrata Schwein. In ravine on Lehigh Mt. south of Lehigh University. June 15, 1900. (J. A. Ruth.)
Carex vestita Willd. In sandy woods, Pen Argyl. (Porter.)
Carex stricta Lam. In swamps. (Porter.)
Carex stricta angustata (Boott.) Bailey. (Porter.)
Carex torta Boott. In wet places. (Porter.)
Carex prasina Wahl. In ravine, Lehigh Mt., south of Lehigh University. June 15, 1900. (J. A. Ruth.)
Carex crinita Lam. In wet places. (Porter.)
Carex gynandra Schwein. In swamps, Seidersville. (Porter.)
Carex virescens Muhl. Near Easton. (Porter.) In woods, Lehigh Mt. July 1, 1899.
Carex costellata Britton. In woods. (Porter.)
Carex triceps Michx. In woods on Lehigh Mt. south of Lehigh University. June 15, 1900. (J. A. Ruth.)
Carex gracillima Schwein. In moist woods. (Porter.)
Carex Davisii Schwein. & Torr. In moist thickets and meadows along Delaware river, Easton. (Porter.)
Carex grisea Wahl. In woods and thickets, Easton. (Porter.)
Carex glaucodea Tuckerm. In open fields at Easton, Pen Argyl and Bethlehem. (Porter.)
Carex granularis Muhl. In bogs or meadows. (Porter.)
Carex granularis Schriveri Britton. At Easton. (Porter.) This is the only county in Penna. from which this plant is reported in Porter's Flora.
Carex conoidea Schk. In meadows. At Easton. (Porter.)
Carex oligocarpa Schk. In dry woods and thickets, Chestnut Hill, Easton. (Porter.)
Carex Hitchcockiana Dewey. In woods and thickets, College Hill, Easton. (Porter.)
Carex tetanica Schk. In grassy meadows and wet woods. (Porter.)
Carex laxiflora Lam. In dry woods, Lehigh Mt. May 13, 1899.
Carex laxiflora patulifolia (Dewey) Carey. (Porter.)
Carex styloflexa Buckley. In woods and thickets. (Porter.)
Carex digitalis Willd. In woods and thickets. (Porter.)
Carex laxiculmis Schwein. In woods and thickets, Chestnut Hill, Easton. (Porter.)

CAREX SETIFOLIA (Dewey) Britton. In dry or rocky soil, preferring limestone rocks, at Easton. (Porter.)
CAREX PEDICELLATA (Dewey) Britton. In dry soil. (Porter.)
CAREX PENNSYLVANICA Lam. On dry hillsides on Lehigh Mt.
CAREX VARIA Muhl. On dry hillsides on Lehigh Mt. near South Bethlehem.
CAREX NIGRO-MARGINATA Schwein. In dry soil, Seidersvillle. (Porter.)
CAREX UMBELLATA Schk. In dry or arid soil. (Porter.)
CAREX PUBESCENS Muhl. In woods, College Hill, Easton. (Porter.)
CAREX WILLDENOVII Schk. In dry soil or woods. (Porter.)
CAREX LEPTALEA Wahl. In wet places. (Porter.)
CAREX VULPINOIDEA Michx. In wet soil along canal at Bethlehem and along mountain stream near Lehigh University. June 20, 1899.
CAREX STIPATA Muhl. In wet meadows along Monocacy creek near Bethlehem. May 30, 1899.
CAREX ROSEA Schk. Easton (Porter) ; on dry hillsides on Lehigh Mt.
CAREX RETROFLEXA Muhl. In woods. (Porter.)
CAREX MURICATA L. On College Hill, Easton. (Porter.)
CAREX SPARGANIOIDES Muhl. Along roadsides, Bethlehem. May 13, 1899.
CAREX CEPHALOIDEA Dewey. In dry fields and on hills. (Porter.)
CAREX CEPHALOPHORA Muhl. In stony thickets near Bethlehem. May 30, 1899.
CAREX MUHLENBERGII Schk. On summit of Lehigh Mt. in rocky soil. June 15, 1900. (J. A. Ruth.) At Easton and Seidersville. (Porter.)
CAREX MUHLENBERGII XALAPENSIS (Kunth.) Britton. (Porter.)
CAREX STERILIS Willd. In sandy or moist soil. (Porter.)
CAREX INTERIOR CAPILLACEA Bailey. At Bangor. (Porter.)
CAREX CANESCENS L. In wet places. (Porter.)
CAREX BROMOIDES Schk. In wet places. (Porter.)
CAREX SICCATA Dewey. In dry fields and on hills, Bethlehem. (Porter.) This is the only county in the state from which it is reported in Porter's Flora.
CAREX TRIBULOIDES Wahl. In meadows. (Porter.)
CAREX SCOPARIA Schk. In wet soil along canal at Bethlehem. June 20, 1899.
CAREX CRISTATELLA Britton. In meadows and low thickets. (Porter.)
CAREX FOENEA Willd. In dry woods, often on rocks. (Porter.)
CAREX FOENEA PERPLEXA Bailey. (Porter.)
CAREX STRAMINEA Willd. In rocky ravine on Lehigh Mt. June 15, 1900. (J. A. Ruth.)
CAREX FESTUCACEA Willd. In dry or moist soil. (Porter.)

ARACEAE

ARISAEMA TRIPHYLLUM (L.) Torr. In moist woods on Lehigh Mt; along Saucon creek near Hellertown; at Walnutport. Generally distributed. May 12, 1896.
ARISAEMA DRACONTIUM (L.) Schott. In moist sandy soil along Lehigh river at Bethlehem, a single specimen being found, with mature fruit. Sept. 15, 1900.
CALLA PALUSTRIS L. In bogs. (Porter.)
SPATHYEMA FOETIDA (L.) Raf. In marshy soil along Monocacy creek. Abundant. April 20, 1898.
ORONTIUM AQUATICUM L. In swamps. (Porter.)
ACORUS CALAMUS L. In wet places. (Porter.)

LEMNACEAE

SPIRODELA POLYRHIZA (L.) Schleid. In rivers and ponds. (Porter.)
LEMNA TRISULCA L. In still or flowing water. (Porter.)
LEMNA PERPUSILLA Torr. In ponds, rivers, and springs. (Porter.)
LEMNA MINOR L. In ponds and stagnant water. (Porter.)

COMMELINACEAE

Commelina nudiflora L. In sandy soil along the Lehigh river at Glendon. Aug. 25, 1902.
Commelina communis L. In waste places, Bethlehem.

PONTEDERIACEAE

Pontederia cordata L. In wet soil along Lehigh river at Island Park. Aug. 25, 1901.
Heteranthera reniformis R. & P. In mud or shallow water. (Porter.)
Heteranthera dubia (Jacq.) MacM. In still water. (Porter.)

JUNCACEAE

Juncus effusus L. In moist soil along the canal at Bethlehem. June 20, 1899.
Juncus bufonius L. Frequenting dried-up pools, borders of streams and roadsides. (Porter.)
Juncus tenuis Willd. In dry sandy paths along Lehigh river, Bethlehem. July 15, 1899.
Juncus secundus Beauv. In fields, Bethlehem. July 10, 1899.
Juncus marginatus Rostk. In grassy places. (Porter.)
Juncus nodosus L. (Porter.)
Juncus canadensis J. Gay. (Porter.)
Juncus canadensis subcaudatus Engelm. (Porter.)
Juncus acuminatus Michx. Frequents moist soil. (Porter.)
Junoides campestre (L.) Kuntze. In wood lands. (Porter.)

MELANTHACEAE

Chamaelirium luteum (L.) A. Gray. In moist meadows and thickets. (Porter.)
Melanthium latifolium Desr. In dry woods and on hills. (Porter.)
Veratrum viride Ait. In moist ground at Wind Gap. (G. W. Caffrey.)
Uvularia perfoliata L. In moist thickets and woods on Lehigh Mt. and along canal near Bethlehem. May 17, 1897.
Uvularia sessilifolia L. In thickets along canal one mile east of Bethlehem. May 9, 1898.

LILIACEAE

Hemerocallis fulva L. In meadows and along streams. (Porter.)
Allium vineale L. In fields near Bethlehem. July 10, 1897.
Lilium philadelphicum L. In dry woods. (Porter.)
Lilium canadense L. In swamps and meadows. (Porter.)
Lilium superbum L. In meadows and marshes. (Porter.)
Lilium tigrinum Andr. Escaped from cultivation along fence 3 miles north of Bethlehem.
Erythronium americanum Ker. In moist sandy soil along towpath east of Bethlehem. April, 1896.
Ornithogalum umbellatum L. In meadows along Saucon Creek about one mile from its mouth. Native of Europe. June 1, 1901.
Ornithogalum nutans L. In damp soil along canal one mile east of Bethlehem.
Muscari botryoides (L.) Mill. In waste places along roadsides, Bethlehem.

CONVALLARIACEAE

Asparagus officinalis L. In thickets and along fences and waste places, Bethlehem. May 30, 1899.
Vagnera racemosa (L.) Morong. In shaded places along Monocacy and Saucon creeks. May 30, 1899.

Vagnera stellata (L.) Morong. In moist soil. (Porter.)

Unifolium canadense (Desf.) Greene. Along mountain streams in moist and shady places on Lehigh Mt. near Lehigh University. Altitude 900 feet. May 30, 1900; also at Nazareth.

Polygonatum biflorum (Walt.) Ell. In woods near Bethlehem and in thickets along Saucon creek. May 17, 1897.

Polygonatum commutatum (R. & S.) Dietr. In moist woods and along streams. (Porter.)

Medeola virginiana L. In damp soil, Lehigh Mt., vicinity of Lehigh University. June, 1901.

Trillium cernuum L. In rich woods. (Porter.)

SMILACEAE

Smilax herbacea L. In woods and thickets on Lehigh Mt.

Smilax glauca Walt. In dry sandy soil. (Porter.)

Smilax hispida Muhl. In thickets. (Porter.)

Smilax rotundifolia L. In woods and thickets. (Porter.)

AMARYLLIDACEAE

Hypoxis hirsuta (L.) Coville. In dry soil on Lehigh Mt. May 30, 1897.

Narcissus Pseudo-Narcissus L. Escaped from cultivation. (Porter.)

DIOSCOREACEAE

Dioscorea villosa L. Along Lehigh river in moist soil at Bethlehem.

IRIDACEAE

Iris versicolor L. Along Monocacy creek in thickets.

Gemmingia chinensis (L.) Kuntze. On hills and along roadsides. (Porter.)

Sisyrinchium graminoides Bicknell. In grassy places, sometimes in woods. (Porter.)

Sisyrinchium angustifolium Mill. On grassy hillsides, Lehigh Mt., near South Bethlehem; altitude 900 feet. May 30, 1900.

ORCHIDACEAE

Cypripedium acaule Ait. In woods and thickets, Lehigh Mt., near South Bethlehem. May 15, 1896.

Cypripedium hirsutum Mill. In woods on Bougher Hill, Williams Township. (J. A. Ruth.)

Cypripedium parviflorum Salisb. In rich woods and thickets. (Porter.)

Orchis spectabilis L. In rich woods. (Porter.)

Habenaria bracteata (Willd.) R. Br. In woods and meadows. (Porter.)

Habenaria ciliaris (L.) R. Br. In meadows. (Porter.)

Habenaria grandiflora (Bigel.) Torr. In rich woods and meadows. (Porter.)

Pogonia ophioglossoides (L.) Ker. In meadows and swamps. (Porter.)

Pogonia trianthophora (Sw.) R.S.P. In rich woods. (Porter.)

Gyrostachys plantaginea (Raf.) Britton. Moist banks and woods. (Porter.)

Gyrostachys cernua (L.) Kuntze. In moist ground on Lehigh Mt. in vicinity of Lehigh University. (G. W. Caffrey.)

Gyrostachys gracilis (Bigel) Kuntze. In dry, open fields and open woods. (Porter.)

Peramium pubescens (Willd.) MacM. In dry woods. (Porter.)

Leptorchis liliifolia (L.) Kuntze. In moist shady grounds, Lehigh Mt. May 30, 1900.

Corallorhiza odontorhiza (Willd.) Nutt. In woods. (Porter.)

Corallorhiza multiflora Nutt. In woods. (Porter.)

Limodorum tuberosum L. In bogs and meadows. (Porter.)

JUGLANDACEAE

JUGLANS NIGRA L. On rocky hillsides, Lehigh Mt.; along the Monocacy creek in meadow land.
JUGLANS CINEREA L. In rocky soil, Lehigh Mt.
HICORIA MINIMA (Marsh.) Britton. In moist woods and swamps. (Porter.)
HICORA OVATA (Mill.) Britton. In rich soil. (Porter.)
HICORA ALBA (L.) Britton. In rich soil. (Porter.)
HICORIA MICROCARPA (Nutt.) Britton. In rich woods. (Porter.)
HICORIA GLABRA (Mill.) Britton. In dry soil along Monocacy Creek near Bethlehem.

MYRICACEAE

COMPTONIA PEREGRINA (L.) Coulter. On hillsides, Lehigh Mt., near South Bethlehem. In dry woods in Williams Township. In fruit July 1, 1899.

SALICACEAE

POPULUS ALBA L. In cemetery and yards at Bethlehem. March 18, 1898.
POPULUS BALSAMIFERA L. In moist soil along Lehigh river, Bethlehem; on dry rocky soil three miles north of Bethlehem. July 15, 1899.
POPULUS BALSAMIFERA CANDICANS (Ait.) A. Gray. In woods and fields. (Porter.)
POPULUS GRANDIDENTATA Michx. In rich woods. (Porter.)
POPULUS TREMULOIDES Michx. In dry or moist soil. (Porter.)
SALIX NIGRA Marsh. Along streams and lakes. (Porter.)
SALIX LUCIDA Muhl. In swamps and along streams. (Porter.)
SALIX FRAGILIS L. Escaped from cultivation. (Porter.)
SALIX ALBA L. In moist soil along the Lehigh river.
SALIX BABYLONICA L. In moist soil along Monocacy creek.
SALIX PURPUREA L. Sparingly escaped from cultivation. (Porter.)
SALIX FLUVIATILIS Nutt. Along streams and lakes. (Porter.)
SALIX BEBBIANA Sarg. In dry soil along streams. (Porter.)
SALIX HUMILIS Marsh. In dry soil. (Porter.)
SALIX SERICEA Marsh. In swamps and along streams. (Porter.)
SALIX VIMINALIS L. In wet soil along Lehigh River at Island Park.
SALIX CORDATA Muhl. In wet soil. (Porter.)

BETULACEAE

CARPINUS CAROLINIANA Walt. In moist woods and along streams. (Porter.)
OSTRYA VIRGINIANA (Mill.) Willd. In dry woods. (Porter.)
CORYLUS AMERICANA Walt. In thickets in Williams Township. July 28, 1900.
CORYLUS ROSTRATA Ait. In thickets, in dry soil at Wind Gap.
BETULA POPULIFOLIA Marsh. In moist or dry soil. (Porter.)
BETULA NIGRA L. Along Lehigh river at Bethlehem. May 1, 1898.
BETULA LENTA L. On hillsides on rocky soil on Lehigh Mt. near Bethlehem; also in Williams Township. April 29, 1902. Fruit June 25, 1902.
ALNUS INCANA (L.) Willd. In wet soil. (Porter.)
ALNUS RUGOSA (DuRoi.) K. Koch. In sandy soil along Lehigh river, Bethlehem. April, 1900.
ALNUS GLUTINOSA (L.) Medic. In wet places. (Porter.)

FAGACEAE

FAGUS AMERICANA Sweet. In woods, Lehigh Mt.
CASTANEA DENTATA (Marsh.) Borkh. General throughout the county in rich soil. June 25, 1898.
QUERCUS RUBRA L. In dry soil, Bethlehem.
QUERCUS PALUSTRIS DuRoi. Along towpath one mile east of Bethlehem. In fruit Oct. 1, 1900.

Quercus coccinea Wang. In dry soil. (Porter.)
Quercus velutina Lam. In woods near Fountain Hill. (J. A. Ruth.)
Quercus nana (Marsh.) Sarg. In sandy or rocky soil. (Porter.)
Quercus marylandica Muench. In dry soil. (Porter.)
Quercus alba L. In woods near South Bethlehem. (J. A. Ruth.)
Quercus minor (Marsh.) Sarg. In dry soil. (Porter.)
Quercus macrocarpa Michx. In rich soil. (Porter.)
Quercus platanoides (Lam.) Sudw. In moist or swampy soil. (Porter.)
Quercus Prinus L. In dry soil. (Porter.)
Quercus acuminata (Michx.) Sarg. In dry soil. Bethlehem.
Quercus prinoides Willd. In dry or sandy soil. (Porter.)

ULMACEAE

Ulmus americana L. In moist soil. (Porter.) Along Lehigh river east of Bethlehem.
Ulmus campestris L. Adventive or naturalized from Europe on Bushkill creek. (Porter.)
Ulmus fulva Michx. In dry rocky soil along Monocacy Creek.
Celtis occidentalis L. In dry rocky soil along Monocacy and Saucon creeks and Lehigh river. May 6, 1900.
Celtis crassifolia Lam. (Porter.)

MORACEAE

Morus rubra L. In dry soil along the canal east of Bethlehem. May 20, 1900.
Morus alba L. In fields and hillsides, Bethlehem. May 18, 1899.
Humulus Lupulus L. In thickets and hedges near Bethlehem. July 22, 1899.
Cannabis sativa L. In waste places and along roadsides, South Bethlehem.

URTICACEAE

Urtica dioica L. In waste places, Bethlehem.
Urtica gracilis Ait. In waste places, Bethlehem. (J. A. Ruth.)
Urticastrum divaricatum (L.) Kuntze. In woods near South Bethlehem. (J. A. Ruth.)
Adicea pumila (L.) Raf. In moist wet places. (Porter.)
Boehmeria cylindrica (L.) Willd. In moist ground along Lehigh River. July 15, 1899.
Boehmeria cylindrica scabra Porter. (Porter.)

SANTALACEAE

Comandra umbellata (L.) Nutt. In dry fields and thickets. (Porter.)

ARISTOLOCHIACEAE

Asarum canadense L. In rich soil in thickets along canal one mile east of Bethlehem; along Saucon creek. June 1, 1901.
Asarum reflexum Bicknell. In rich soil along streams. (Porter.)
Aristolochia serpentaria L. In rich woods in Williams Township.

POLYGONACEAE

Rumex Acetosella L. In dry fields. Common. May 6, 1897.
Rumex Patientia L. In dry fields at Bethlehem. June 5, 1897.
Rumex crispus L. In waste places at Bethlehem. (J. A. Ruth.)
Rumex obtusifolius L. In waste places, South Bethlehem. Oct. 30, 1897.
Fagopyrum Fagopyrum (L.) Karst. In waste places and along railroad tracks, Bethlehem.
Polygonum amphibium L. In ponds and lakes. (Porter.)

Polygonum emersum (Michx.) Britton. In swamps or moist soil. (Porter.)
Polygonum incarnatum Ell. In wet soil. (Porter.)
Polygonum pennsylvanicum L. In waste places near Bethlehem. Sept. 17, 1895.
Polygonum Persicaria L. In waste places. (Porter.)
Polygonum hydropiperoides Michx. In swamps or wet soil. (Porter.)
Polygonum Hydropiper L. In waste places about Bethlehem. (J. A. Ruth.)
Polygonum punctatum Ell. In wet, sandy soil, Bethlehem. Aug. 5, 1899.
Polygonum orientale L. In waste places, Bethlehem; along canal near Glendon.
Polygonum virginianum L. In thickets along towpath near Bethlehem.
Polygonum aviculare L. Common in waste places, Bethlehem. Sept. 4, 1899.
Polygonum littorale Link. On shores and in waste places. (Porter.)
Polygonum erectum L. In moist or dry soil. (Porter.)
Polygonum tenue Michx. In dry soil. (Porter.)
Polygonum Convolvulus L. In waste or cultivated grounds. (Porter.)
Polygonum cilinode Michx. In rocky places. On both sides of Delaware river at Easton. (Porter.)
Polygonum scandens L. In thickets and waste places, Bethlehem. July 22, 1899.
Polygonum sagittatum L. In moist ground along Monocacy creek, one mile from Bethlehem. Aug. 12, 1899.
Polygonum arifolium L. In marshy ground along Monocacy Creek near Bethlehem.
Polygonum hernarioides Del. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.

CHENOPODIACEAE

Chenopodium album L. Common in waste places, Bethlehem.
Chenopodium viride L. In waste places, Bethlehem.
Chenopodium glaucum L. Along streets of Easton. (Porter.) Along P. & R. R. R. tracks, South Bethlehem. July 22, 1899.
Chenopodium Boscianum Moq. In woods and thickets, Easton. (Porter.)
Chenopodium murale L. In waste places. (Porter.)
Chenopodium hybridum L. In woods and sometimes in waste places. (Porter.)
Chenopodium Bonus-Henricus L. In waste places and in moist soil along Monocacy creek, Bethlehem. Aug. 12, 1899.
Chenopodium Botrys L. Along towpath, Bethlehem. Aug. 5, 1899.
Chenopodium ambrosioides L. In waste places, Bethlehem. (J. A. Ruth.)
Roubieva multifida (L.) Moq. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Torrey Bulletin Jan., 1892.
Blitum capitatum L. In dry soil. (Porter.)
Atriplex hastata L. Along the railroads near Bethlehem. (E. A. Rau in Bull. Torrey Club Oct., 1881.)

AMARANTHACEAE

Amaranthus hybridus L. In waste places and along roadsides, Bethlehem. Sept. 15, 1900.
Amaranthus hybridus paniculatus (L.) Uline. & Bray. In waste grounds, Bethlehem.
Amaranthus graecizans L. In ballast along railroads, Bethlehem. Sept. 3, 1899; in waste places, Glendon.
Amaranthus deflexus L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
Amaranthus Blitum L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.

PHYTOLACCACEAE

Phytolacca decandra L. In moist soil along Saucon creek; in hedges and thickets, Bethlehem. July 10, 1899.

AIZOACEAE

Mollugo verticillata L. In waste places, Bethlehem. Aug. 16, 1900.

PORTULACACEAE

Claytonia virginica L. In moist thickets along Lehigh canal two miles east of Bethlehem. May 2, 1896.

Portulaca oleracea L. In waste places and along roadsides, Bethlehem.

Portulaca grandiflora Hook. Occasionally escaped from cultivation and in waste places.

CARYOPHYLLACEAE

Agrostemma Githago L. Generally distributed in grain fields. Ascends on Lehigh Mt. to 940 feet. May 12, 1896.

Silene stellata (L.) Ait. In woods. (Porter.)

Silene vulgaris (Moench.) Garcke. In meadows and waste places. (Porter.)

Silene virginica L. In rocky woods in Allen township. June 3, 1901.

Silene caroliniana Walt. In dry or rocky soil. (Porter.)

Silene antirrhina L. In fields and waste places, Bethlehem. June 20, 1899.

Silene Armeria L. Occasionally in waste places, Bethlehem.

Silene noctiflora L. In waste places, Bethlehem.

Silene Anglica L. In waste places. (Porter.)

Lychnis alba Mill. In waste places, Bethlehem.

Saponaria officinalis L. In waste places, Bethlehem; also in Allen township. July 13, 1898.

Vaccaria Vaccaria (L.) Britton. Along L. V. R. R. track, Bethlehem.

Dianthus Armeria L. In fields and along roadsides. (Porter.)

Alsine uliginosa (Murr.) Britton. In cold brooks and springs. (Porter.)

Alsine media L. In gardens, lawns, and waste places, Bethlehem. Common. May 6, 1900.

Alsine longifolia (Muhl.) Britton. In moist grounds along Lehigh canal one mile east of Bethlehem. June 3, 1899.

Alsine graminea (L.) Britton. In fields and waste places. Aug., 1898.

Cerastium viscosum L. In waste places, Bethlehem. (J. A. Ruth.)

Cerastium semidecandrum L. In dry soil on Lehigh Mt. June 12, 1897.

Cerastium vulgatum L. In thickets along roadsides, Bethlehem. May 30, 1899.

Cerastium longipedunculatum Muhl. In moist shaded places. (Porter.)

Cerastium arvense L. In dry, rocky places. (Porter.)

Sagina procumbens L. In streets, Bath. (Porter.)

Arenaria serpyllifolia L. In fields and cemeteries, Bethlehem. May 20, 1900.

Arenaria stricta Michx. In dry, rocky places. (Porter.)

Anychia dichtoma Michx. In woods on Lehigh Mt.

Anychia Canadensis (L.) B.S.P. In dry woods two miles east of Bethlehem. July 22, 1911.

Scleranthus annuus L. In fields and waste places. (Porter.)

NYMPHAEACEAE

Brasenia purpurea (Michx.) Casp. In ponds and slow streams. (Porter.)

Nymphaea advena Soland. In Lehigh river at Calypso Island, Bethlehem, and at Freemansburg. Aug. 25, 1901.

Castalia odorata (Dryand.) Woodv. & Wood. In Lehigh river at Island Park. Aug. 25, 1901.

(To be continued)

REVIEWS

Payne's Manual of Experimental Botany

This manual is conceived in an excellent spirit, and its purpose, as stated in the preface, is "to teach botany by experiment." The publisher's announcement describes it as "a laboratory manual for a complete high school course, in which botany is continually correlated with practical gardening, farming, and bacteriology." In this continuous correlation lies what the reviewer considers one of the main weaknesses of the book. Undoubtedly the movement to introduce the study of the principles of agriculture into secondary schools is a movement in the right direction, but why agricultural matter should be eternally mixed in with botany until the latter science loses all semblance of its real self, it is difficult to comprehend. To read (p. 45 et seq.) directions for a high school pupil, *as part of a course in experimental botany* (!) to "visit a farm," and "describe a plow" and tell how it is used; to investigate the economic problem of "why truck farms abound near cities"; to "visit a wheat field at harvest time and observe the process [what process is not stated] at each step"; to investigate "the way in which the various small fruits and vegetables are gathered and prepared for marketing"; to "visit a commission merchant's place of business *at any season*" and "make a list of the products *by season*" (*sic*); to describe the process of milling; to "visit a saw-mill and see how logs are reduced to various kinds of lumber"; to read this in what professes to be a text book of botany, leaves no room for doubt that it is high time to call a halt in the emasculation of high school botany. Let us teach agriculture, by all means, in the proper time and place, but let us not confuse and deceive the pupil by making him think that plowing and milling and market gardening are a part of the science of botany, any more than the daily work of the butcher has anything to do with the science of zoölogy.

To follow the author through the book requires several new adjustments of ideas. Thus the first exercise on page 49, to

* Payne, Frank Owen.—Manual of Experimental Botany, pp. 1–272, figs. 117. New York. American Book Company. 1912.

find out, by observation, the parts of a seed, can by no strain of words be called an experiment, and the wisdom of the author's plan, as stated in the Preface (p. 3), "to present the morphological part also in the form of experiments," may be regarded as questionable from a pedagogical standpoint, as tending to give the pupil a quite erroneous notion of what an experiment really is. To call seeds, water, leaves, *et cetera* "apparatus," seems really unfortunate, for the pupil will surely have to abandon this notion entirely if he continues scientific studies in more advanced grades. Incidentally, this material is omitted in the list of required apparatus on page 270.

On page 38 mineral nutrients are erroneously called "plant foods," and the definition on page 52, "An embryo is an immature or undeveloped plant or animal," would include boys and saplings. On page 58, in an experiment "*To find how to make the embryo plant begin to grow*," the pupil is directed to plant seeds in sawdust in three tumblers, one of which is not watered, the second kept moist, and the third saturated by having the tumbler filled with water. The next direction is to place the tumblers where the seeds in all three will have the same amount of air (!) and heat. As the "conclusion," the pupil is directed to "state the effect of water on germination as shown by the experiment." The appended suggestion is for the pupil to visit a malt house and test the malt for starch and grape sugar, and then the question of water supply is again taken up. The "reference work" in connection with the subject of "heliotropism" (p. 101) is to "find out how beet sugar is obtained, tracing the process from seedtime to the manufactured product." On page 109 it is implied that the conclusion and the result of an experiment are synonymous. On pages 70–71, the heading of the work dealing with the retardation of growth by the removal of cotyledons from a germinating seed is "Effect of mutilation," though the pupil is led to question the true significance of his experiment in a "query"; so also in connection with root-hairs, on page 104. It is implied on page 78 that, owing to diminished water supply, desert plants are of small stature, thus ignoring the existence of such large desert plants as the giant cactus. But such in-

accuracies are too numerous to mention: *e. g.*, node for internode (probably) on page 112, growing point synonymous with plumule (p. 114), object of experiment stated quantitatively and the experiment carried through qualitatively (pp. 130–131), further experimentation assigned as "reference work" (p. 137), "leaves exert an upward pull"! (p. 151), the implication that government encouragement of tree planting in the western states is closely correlated with transpiration (p.156), the implication that the release of oxygen in photosynthesis accounts for the greater "purity" of country air over city air (pp. 165–166), the definition of pollination as the reception of pollen *by the ovules* (p. 187), the implication that Jack-in-the-pulpit is the same as Skunk Cabbage (cf. "Jack-in-the-pulpit or Skunk Cabbage"—p. 206, with "Toadflax or Butter and Eggs"—p. 212), and so on.

On page 153, the old method of shielding a portion of a leaf from light by corks, long since shown to be fallacious by both King and Ganong, is retained, and the object of this experiment in starch-making is stated in the indefinite way, "To discover the effect of light upon foliage."

But there are also good points about the book. The device on page 59 for exposing germinating seeds to differential water supply, the experiment (p. 87) to show, by using eosin and methyl green, that the path of liquid up in a parsnip root is different from the path of the liquid down, and many of the illustrations—notably figures 47, 59, 98, and 115, are excellent.

The reviewer feels that it is unfortunate for the author and for high school pupils and teachers that the manuscript was not submitted by both author and publisher to some competent botanist or university teacher before being printed. As is usual with this publishing house, the date of publication is nowhere given, and the reviewer regards this as a serious defect, especially in a text book on any science. The press work and binding are excellent, but think of omitting an index in the year of our Lord one thousand nine hundred and twelve!

C. Stuart Gager

CURRENT LITERATURE

In the *Educational Review* for November Professor H. M. Richards, of Barnard College, discusses Botany in the College Course. Since lack of space prevents reprinting the entire article, the following brief notes are presented. After mentioning the early emphasis on classification and terminology and the present common idea that "there is nothing of general importance or of compelling interest in the study of plants," Professor Richards points out that "the pendulum has, perhaps, swung a little too far away from what has been called the "knowing of plants." So much so that students sometimes complain that their "course in botany has not given them enough opportunity to learn the names of plants, thus placing the less experienced teacher in somewhat of a quandary as to whether it be better that the student be instructed in the fundamental principles of plant structure and behavior or that he simply be enabled to name the individual plants which may be seen in his walks abroad. There is, however, no doubt as to which is preferable from the standpoint of training and general education, and botanical teachers are to-day universally agreed that it is the principles which should be taught as affording the student a comprehensive outlook over a branch of knowledge which is in reality of the first importance to the human race. Ability to name the flowers is an interesting accomplishment for the amateur, but as a mere avocation it is not a pursuit which in itself often leads to any great intellectual advance for the student, and may degenerate into an occupation scarcely of more intrinsic value than the collecting of postage stamps."

This paper, however, was written to show what botany is capable of as a means of scientific discipline. "For the very reason that botany is no longer merely the study of gross morphology largely expressed in terms of classification, there is less ease than there used to be in delimiting it sharply from other sciences,—not the least indeed of its advantages, educationally speaking. Formerly there was commonly understood to be a fairly clear distinction between the exact experimental sciences, like physics and chemistry, and the purely observational ones

like botany and zoölogy, at least as they were taught. Now, however, the great increase in the development of the experimental side, which in its last analysis leads to the provinces of chemistry and physics, makes botany for instructional purposes, as well as for itself, a science in which pure observation is greatly tempered by experiment. Such a combination is a peculiarly fortunate one, and it is just here that botany presents practical educational advantages over almost any other science. We have, then, the possibility of training students in direct observation from natural objects in conjunction with observation of experimental phenomena from which conclusions may be drawn more or less indirectly."

Important also is the ability to see things as they are without prejudgment or prejudice. While the value is the same in training in any kind of clear thinking, *e. g.*, mathematics or botany, the laboratory makes its own addition to the value of a science like botany. There the student comes in actual contact with the living material. "He learns in the beginning that each line that he draws has its meaning and that no careless slipshod sketch can represent with accuracy the object before him. He then further finds that sins of omission are equally fatal to accurate representation as sins of commission. He must recognize the naked truth. It is not the question of his own or any one else's opinion whether a certain appearance is or is not as he thinks he has observed it, but it is a question of fact, and he is forced to appeal to the object itself for his answer. Another point of advantage is the segregation of the student in the laboratory, since he is thereby forced to do his own work and his own thinking. It is the fault of the instructor if he is helped too much or is allowed to be prejudiced by drawings or descriptions of the objects studied. It was this spirit which imbued the teaching of the elder Agassiz, and which, in a modified form, is still recognized as an important principle of the best instruction. Of course, like all things good in themselves, the practice of making the student work for himself can be overdone, for it is impossible for the ontogeny of the mental development of an individual to recapitulate *in toto* the phylogeny of the develop-

ment of a science. And if it were not impossible, certainly it would be absurd. It is for the instructor to make sure that the student does not waste his time and energy in floundering among problems that his experience could not enable him to solve, and at the same time to bear in mind that it is not simply information which the student needs. Even the best scholar will think he sees what he is told to see, be his instructor a book or a person, and if informed before he has made an attempt to investigate for himself, he gains no power to overcome difficulties in observation. In other words, it is the increase in power of a previously untrained faculty which makes this instruction, if properly carried out, profitable in the broadest sense. It is not to be supposed that the particular observational problems presented to him in the laboratory will ever face the individual in the outside world; in all probability they will not; but the necessity of independent observation and of drawing conclusions therefrom certainly may face him, and he can meet them more successfully if his mind and his eye are habituated to work coördinately. Preëminently in the laboratory is this training afforded; a slow process, perhaps, and an expensive one, too, educationally considered, but more than worth the cost both in time and energy."

Such work "resolves itself fundamentally into seeing things as they are, interpreting the observations by the simplest processes of clear thinking, and finally recording both the object itself and the conclusions drawn from it, with strict honesty. The net result is clear seeing, clear thinking, and a clear conscience." Emphasizing the common sense fact that the problems should be carefully chosen, lying within the range of possible interest yet never narrowed into a tiresome repetition of endeavor, the author passes to a "lesser though entirely legitimate purpose, namely, the increasing of the pleasurable appreciation of the things of the world, and consequently the enlargement of the ability for rational enjoyment of life." The stimulus botany offers to the imagination, "one of the most valuable assets of an individual in determining his success for himself and his value to the community."

In a college course the sub-divisions of botany have various undisputed utilitarian values from the informational view point. The contribution of botany to medicine lies not only in its relation to bacteriology, but in the suggestive field of plant physiology. Recognizing that a certain amount of botanical fact must of course be presented in one way or another to the student, the author insists that the "relation of the science to other fields of knowledge should be accentuated, whether it be to the obviously allied one of zoölogy or to the more remote one of economics, for the ramifications of a subject like botany are so many and so far-reaching that it touches upon many lines."

After indicating appropriate types of work for the several college years, the author closes with the opinion that "in both a purely pedagogical and informational sense, botany and zoölogy rank equally with physics and chemistry in suitability for a required science option in the college course."—J. B.

The American Breeder's Magazine, vol. II, no. 3, contains a syllabus of "Suggestive Laboratory Exercises for a Course in Plant Breeding," prepared by Prof. Arthur Gilbert of the Laboratory of Experimental Plant Breeding at Cornell University.

Twenty-five exercises are submitted covering such studies as: variations in common plants; morphology of flowers; technique and practice in cross pollination; behavior of hybrids of oats, wheat and citrus; critical examination of cytological preparations showing nuclear division, chromosomes, pollen mother cells, etc., and special consideration of corn as to behavior of hybrids, xenia, correlation of characters, judging and ear to row tests.

The appearance of this outline is timely. Plant Breeding is destined to take an important place in botanical instruction. The arrangement of an adequate course of laboratory instruction in this subject presents more complications than do most biological branches.

The exercises as presented are of spceial interest as they come from a laboratory which has been a pioneer in teaching the subject of Plant Breeding.—A. B. S.

The Toxicity of Certain Mushrooms of the Genus *Amanita* is a short but important paper by Radais and Sartory in the *Rev. Scien. du Bourbonnais*, etc., **24**: 97–8. In view of the serious aspect of mushroom poisoning this last fall in our vicinity this warning seems to be applicable here as well as in Europe. During the week of September 9, 1911, at least *twenty-two* persons lost their lives and many more were made seriously ill by mushrooms in the vicinity of New York. A translation of this French article follows.

"The autumn of 1911 has brought the usual outbreak of mushroom poisoning, with many fatal cases, caused primarily by eating *Amanita phalloides* Fr. The press considered that it was doing a useful thing in spreading among the people, with the authority of naturalists whose intentions were more laudable than their knowledge, the incorrect and dangerous notion that in treating the mushrooms with boiling water followed by repeated washing in cold water, all danger in eating them had been removed. For a long time mycologists have recognized that this treatment will often remove certain very soluble bitter and poisonous principles but they have never ceased to put people on their guard against the inefficiency of this method in the case of certain species, especially *Amanita phalloides*. The present seems to be an opportune time to confirm this caution with experiments. Our observations were made upon several poisonous species but with special reference to *A. phalloides*. We may sum up the results of our experiments in the following words: *A. phalloides* still preserves its toxic principle unchanged after being heated to boiling for some time; in the dried state its toxicity is not weakened after standing a year nor has it lost its poisonous properties after remaining dry for six years; the poison is still held in the tissues of the mushroom after boiling with water.

"*Therefore it is very unwise to spread broadcast the erroneous idea that all poisonous mushrooms may be rendered harmless by boiling with water and then washing repeatedly in cold water.*" —E. D. C.

Engelmann, Wilhelm: Jubiläums Katalog der Verlagsbuchhandlung Wilhelm Engelmann in Leipzig, 1911, pages 447. This beautiful example of the printer's art gives photographic reproductions of letters to the firm, buildings and members of the firm from 1811 to 1911. It is mainly interesting to the botanist because the Wilhelm Engelmann establishment has been instrumental in the printing of numerous botanical works beginning with Grisebach and ending with Engler. Wilhelm Engelmann is the publisher of "Die natürlichen Pflanzenfamilien," "Die Vegetation der Erde" and "Das Pflanzenreich." The Jubiläums Katalog gives a complete statement of the contents of all these works and thus becomes of value to bibliographers. It commemorates the centenary of this German publishing house.—John W. Harshberger.

A portrait of Charles Mason Hovey with a short sketch of his life has appeared in a recent number of The American Breeders Magazine (vol. II, no. 3). Special mention is made of his important contribution to horticulture in developing the first pistillate strawberry placed upon the market in America and from which practically all the present commercial varieties were derived, and of his success as an editor, author, plant breeder, nurseryman and merchant. He was born in Massachusetts in 1810 and lived in his native state until his death in 1887.—A. B. S.

A new text-book of microbiology,* such as the present one, is a useful compendium consisting of chapters written by a number of specialists, who have, under the editorial supervision of Charles E. Marshall, provided the fundamental and guiding principles which are basic to an interpretation of such subjects as air impurities, water supplies, sewage disposal, soils, dairying, fermentation industries, food preservation and decomposition, manufacture of biological products, transmission of disease, susceptibility and immunity, sanitation, and control of infectious or contagious diseases.

* *Marshall, Charles E.* (Editor), and other Contributors:—Microbiology for Agricultural and Domestic Science Students. (Pages i–xxi + 1–724. Philadelphia. P. Blakiston's Son & Co.)

The plan of a text-book in microbiology, which seeks to furnish basic principles, must assume a definite and systematic arrangement. With this in view, the text, amply illustrated with figures, has been divided into three parts: Morphological and Cultural, or that which deals with lower forms of life and methods of handling; Physiological, or that which deals strictly with functions; Applied, or that which reaches into the application of the facts developed to the problems met in the study of professional or practical affairs of agriculture, or domestic science.—John W. Harshberger.

NEWS ITEMS

We learn from *Science* that under the auspices of the Geographical Society of Philadelphia, a botanic and geographic expedition is to be made this summer to southern Florida by Professor John W. Harshberger, of the University of Pennsylvania. Professor Harshberger has made two previous trips to Florida and this expedition is to complete his studies in the Everglades region of the extreme southern part of the peninsula. The itinerary will be approximately as follows: Making Fort Meyers on the west coast headquarters, Professor Harshberger will first investigate the region in that vicinity; visits will be made to several of the islands along the gulf coast; the Caloosahatche will be ascended by power boat to Lake Okeechobee and the flora of that inland lake will be studied. Then the attempt will be made (if the drainage canal has been sufficiently constructed) to cross the Everglades to Fort Lauderdale on the east coast. As no botanical geographer has ever crossed the Everglades, unusual opportunities will be presented to study a region of great scientific interest. Photographs will be taken of the vegetation, the region will be mapped botanically, and a collection of the more interesting plants will be made. An abstract of the results of this expedition will be published in the October number of the *Bulletin* of the Geographical Society of Philadelphia.

The United States Forest Service has prepared a traveling exhibit of photographs for circulation among schools and libraries. It is sent free of expense, except of course transportation charges

(weight 15 pounds). The exhibit consists of 44 pictures, arranged in sets of four, for such topics as forest fires, lumbering, forests and water supply, and how the national forests are used. Applications should be made directly to the Forester, Washington, D. C.

Professor Josephine E. Tilden, of the University of Minnesota, has been given leave of absence on half salary, for the coming year, to carry on botanical research in the Islands of Tahiti and New Zealand.

We learn from *Science* (31 May) that Dr. B. M. Duggar, of Cornell University, has been elected to fill the professorship of plant physiology and applied botany in Washington University, St. Louis.

Professor F. O. Grover, head of the department of botany in Oberlin College, has been appointed by the faculty to represent the college in the Ohio Biological Survey.

At the University of Pennsylvania Guy E. Albert, of York Springs, and John Y. Pennypacker, of Philadelphia, have both received university scholarships in botany.

The following botanists have been elected to the fraternity of Sigma Xi at Columbia University: C. A. Darling, B. O. Dodge, R. C. Benedict, and W. S. Cameron.

TORREYA

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THE DIVERSE HABITATS OF THE EASTERN RED CEDAR AND THEIR INTERPRETATION

By Roland M. Harper

The red cedar of Eastern North America, *Juniperus virginiana* L.* (also called in some recent books *Sabina virginiana*) is noteworthy for the variety of habitats in which it is found; and some writers have regarded it as almost indifferent to environmental conditions.

On the coast of Long Island, Georgia, northeastern Florida, and no doubt at many intermediate points, *Juniperus* grows on the borders of salt and brackish marshes, and in Georgia—perhaps not so much farther north—it is frequent on low sandy islands in the marshes. It is said to grow on dunes on the shores of Lakes Michigan and Erie, and at many places on the Atlantic coast. In West Florida and perhaps elsewhere it is found in the estuarine swamps of muddy rivers. In Middle Georgia, particularly in DeKalb, Rockdale and Columbia Counties, it is frequent, though not abundant, on flat almost bare exposures of granite; and in Alabama and several other states it can be

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* The cedars of central Texas, the Rocky Mountain region and farther west, formerly referred to this species, have been separated by various authorities in recent years, probably with good reason. At the same time those of Florida and neighboring parts of other states have been referred to a West Indian species, *J. Barbadensis* L. But the alleged differences between the northern and southern cedars seem to be no greater than many other trees exhibit in different habitats, and no one has ever succeeded in drawing a sharp line between them on the map. If the Florida cedar was really identical with a West Indian one we would naturally expect to find it in the extreme southern part of the state, like many other tropical trees; but no *Juniperus* seems to have been reported south of Brevard County on the east coast and Manatee on the west. Just what the relationship is between our cedar and those of Bermuda and the Bahamas does not concern the present paper.

seen on sandstone cliffs of various ages, from pre-Cambrian to Carboniferous.

The headquarters of our cedar seem to be in the interior hardwood region of Eastern North America,* from southern Ontario to northern Alabama. There, from all accounts, it was very abundant in the pioneer days, especially on bare limestone rocks, forming the great cedar-glades of Middle Tennessee and adjacent territory, which have been mentioned by many observers (though strange to say no illustrations of them seem to have yet found their way into botanical or geographical literature).

In addition to its natural habitats (of which those already mentioned do not exhaust the list), in southern New England, adjacent New York, and many other places the cedar is most commonly seen scattered in dry pastures and abandoned fields; and in nearly all parts of its range, particularly in the Piedmont region of Virginia, it is a familiar feature of roadsides and fence-rows. It is so common in such artificial or unnatural situations that it would be a difficult task to reconstruct its original distribution.

In most of the places above described *Juniperus* does not have much competition from other trees; but in Florida and some parts of the coastal plain of Georgia and Alabama it is usually found in dense calcareous hammocks, where it is pretty well shaded, even when full grown. It grows in shady places outside

* The interior hardwood region is not a sharply defined geographical unit, but it has certain distinctive characters besides the prevalence of hardwoods and the scarcity of pines. (On this latter point see Gattinger, Fl. Tenn. (ed. 2), 23–24. 1901.) Among them are: rock strata mostly Paleozoic and approximately horizontal, scarcity of sand and peat, wet winters and dry summers (in this connection see Gannett, U. S. Geol. Surv. Water Supply Paper no. 234, *pl. 2*, 1909), considerable seasonal fluctuation of streams, and frequency of polypetalous spring flowers, medicinal plants, and trees with durable dark-colored heart-wood.

There are in the United States about two dozen places named Lebanon, half a dozen New Lebanons, and a few others in which Lebanon forms a part of the name. Quite a number of these are in the interior hardwood region, and it is extremely probable that some of them (especially those in Kentucky, Tennessee and Alabama) were named from the abundance of cedar near by, in allusion to the classical "cedar of Lebanon." Although there is not much resemblance between our cedar and *Cedrus Libani*, the cedar of Lebanon, the people who named most of these places were probably not familiar with the Old World tree, which is not often cultivated in this country.

of the coastal plain, too, at least as far inland as Jefferson County, Alabama. There the characteristic spindle-shaped northern form abounds in old fields and rocky pastures between Birmingham and Bessemer, and the Florida form with loose drooping twigs is scattered through the flatwoods southwest of Bessemer, where it is well shaded by tall oaks and hickories.

In the numerous descriptions of the habitat of the cedar in the northern United States little or nothing is said about its having any particular fondness for lime. But in Alabama and adjoining states, where it is most abundant on limestone rocks, it is generally regarded as a lime-loving tree.* If it is, though, it differs strikingly from all other lime-loving trees of Eastern North America in having scale-like evergreen leaves, which is supposed to be a xerophytic adaptation. An explanation of its apparent fondness for lime will be suggested presently.

Notwithstanding the great adaptability of the cedar to diverse conditions of soil and climate, there are in eastern North America four rather widespread classes of natural habitats where it is conspicuous by its absence: (1) the great northern coniferous forests, extending from New Brunswick westward; (2) the common dry woods with oaks and hickories, which are represented in nearly all the eastern states; (3) the prairies, extending from Indiana westward; and (4) the pine-barrens, including the *Pinus rigida* barrens of Long Island and New Jersey, the *P. palustris* barrens from North Carolina to Texas, and the *P. Caribaea* barrens of South Florida.

Now if the various habitats of our tree can be found to have any one character or combination of characters in common, not shared by the other habitats just named, we will have the key to the situation.

One such character stands out prominently. The coniferous forests, dry woods, prairies and pine-barrens are burned over at intervals of a few to several years (the fires being set oftener now by man than they were by lightning and other natural causes in prehistoric times), while *the habitats affected by the cedar are rarely or never visited by fire.*

* See bibliography at end of this paper.

The sensitiveness of *Juniperus virginiana* to fire, a natural consequence of its thin bark,* has been commented on in some of the general works cited below, if not elsewhere; but the geographical significance of this fact seems never to have been pointed out before.

The various habitats of the cedar are protected from fire in different ways. Marshes and estuarine swamps are usually too wet for fire to travel through, and on dunes and rocks (the latter including the cedar-glades) the herbaceous vegetation is too sparse to feed flames. The exemption of pastures and fence-rows from fire is too obvious to require any further comment. In the Florida hammocks, as in other climax forests, the humus does not burn readily, partly because it is usually too damp, and partly because most of the carbon in it is already oxidized.†

The abundance of cedar on limestone rocks may now be partly explained by the fact that such rocks are most extensively exposed in the interior hardwood region and in other regions which were characterized originally by vast climax forests and now by cultivated fields, where forest fires from natural causes are and always have been very infrequent, apparently. It is possible, however, that a little lime in the soil may be advantageous to our tree, for it seems to be entirely absent from the fall-line sand-hills and stream sand-hills of the coastal plain, which are almost exempt from fire but decidedly non-calcareous; while the dunes on the coast must contain appreciable quantities of calcium carbonate in the form of comminuted sea-shells. Furthermore, outside of the glaciated region *Juniperus Virginiana* seems rarely or never to associate with any of the Ericaceae, a family of plants noted for their preference for acid soils.‡ Never-

* Its usually shallow root-system has been suggested as another factor which makes the cedar an easy prey to fire; but it would be hard to find a tree with shallower roots than *Pinus Caribaea* where it grows on limestone rocks southwest of Cocoanut Grove, Florida, and that species is almost immune to fire. The cedar usually branches near the ground, and that is probably another reason why it is more liable to injury by fire than some other trees.

† In this connection see Bull. Torrey Club **38**: 524. 1911.

‡ In this connection see Hilgard, Soils 522. 1906; Coville, U. S. Bureau of Plant Industry Bull. 193: 19, 30. 1910; Harper, Ann. Rep. Fla. Geol. Surv. **3**: 361. 1911.

theless, the evidence here presented seems to show that the cedar dreads fire more than it likes lime.

Notwithstanding its tolerance of shade and sensitiveness to fire, in which it differs from many other conifers and most pioneer trees, the cedar has other pioneer characters besides its "xerophytic" leaves. It thrives in very thin and poor soils, and is rarely found native in deep rich soils, especially those of alluvial bottoms, where fire-protection is almost at its maximum. In the blue-grass region of Kentucky, which is characterized by rich calcareous soils, it seems to be chiefly confined to dry rocky places, such as the cliffs of the Kentucky River. The Florida hammocks in which our tree abounded before it became the prey of the pencil-makers are very near sea-level (and usually rocky as well), and the marshes and estuarine swamps are of course still lower; so that in all such places the ground-water level is at all times so near the surface that there is only a shallow zone in which aeration can take place and the common soil-forming agencies can work. Perhaps the cedar has little use for earthworms and other nitrogen-producing organisms; its relations to these things deserve investigation.

The following list contains references to about 400 places, mostly in easily accessible publications, where the habitats of *Juniperus virginiana* (as that species is defined at the beginning of this paper) in various parts of Eastern North America are mentioned. No attempt has been made to refer to places where it is merely listed as growing in a certain region, without any indication of habitat, except in a very few cases of special interest. The references for each state are arranged chronologically as far as possible, and the states alphabetically. It may seem tiresome to cite so many pages of the same book in some cases, but the reader who is not sufficiently interested to go into the matter deeply can at least get from this a crude idea of the relative abundance of cedar in each state, and one who may be making a special study of the vegetation of any one state will probably find a multiplicity of references useful.*

* I have found nearly all these references in the libraries of either the Geological Survey of Alabama or the New York Botanical Garden. Most of those relating to Iowa were first brought to my attention by Prof. L. H. Pammel.

General (or relating to more than one state)

F. A. Michaux, Hist. Arb. Am. **3**: 42–44. 1813.

Elliott, Bot. S. C. and Ga. **2**: 717. 1824. (S. C., Ga., Ala.)

Nuttall, N. Am. Silva **3**: 96–98. 1849.

Engelmann, Trans. Acad. Sci. St. Louis **3**: 591–592. 1878.

Rothrock, Forest Leaves **2**: 148–149 (with plate). 1890.

Sargent and others, Garden and Forest **4**: 289; **5**: 46; **8**: 61–62, *f. 9;* **10**: 142, 168, 178, 420. 1891–1897.

Sargent, Silva N. A. **10**: 94. 1896; **14**: 89–90. 1902.

Masters, Jour. Bot. **37**: 1–11. 1899.

Cowles, Bot. Gaz. **27**: 295, 302, 363, 371, 373. 1899. (Dunes of Lake Michigan.)

Mohr, U. S. Forestry Bull. 31. 1901.

Dame and Brooks, Trees of New Eng. 26–28. 1902.

Hilgard, Soils 517. 1906. (Calcareous soils.)

U. S. Forest Service Circulars 73 and 102. 1907.

Britton & Shafer, N. Am. Trees 116–119. 1908.

F. J. Phillips, Forestry Quarterly **8**: 67–69. 1910.

Hall & Maxwell, U. S. Forest Service Bull. **95**: 19–29. 1911.

Harshberger, Phytogeog. Surv. N. A. 1911. (Consult index for numerous references to *Juniperus barbadensis* and *J. virginiana*, some of which however pertain to western trees now regarded as distinct.)

Canada

Macoun, Cat. Can. Pl. 462. 1886. (Rocky river banks mostly.)

Alabama

Tuomey, 1st Rep. on Geol. of Ala. 125, 134, 159. 1850; 2d Rep. 90. 1858.

E. A. Smith, Tenth Census U. S. **6**: 30, 32, 33, 42, 57, 69, 81–83, 93, 107, 112, 116, 129, 131, 133, 148, 155. 1883 (?).

E. A. Smith, Rep. Geol. Surv. Ala. 1881–2 (agricultural features) 199, 205, 206, 230, 269, 296, 330–332, 334, 364, 400, 415, 428, 462, 468, 472, 514, 532. 1883.

Mohr, Tenth Census U. S. **9**: 528, 529. 1884. (Tennessee valley.)

E. A. Smith, Rep. on Geol. of Coastal Plain of Ala. 120, 194, 282, 351, 534, 537, 538, 591, 592, 639, 642, 648, 686. 1894. (Calcareous soils.)

H. McCalley, Rep. on Tenn. Valley 16, 19, 30, 39, 44, 80, 161, 167, 177, 193, 195, 197, 202, 203, 233–235, 237, 249, 250, 259, 261–264, 266, 279, 281, 297, 314–316, 325, 334–336, 351, 367, 372, 374, 406, 409. 1896. (Mostly on limestone.)

H. McCalley, Rep. on Coosa Valley 43, 47, 112, 119, 185, 191, 247, 265, 311, 313–314, 341, 465, 488, 498, 515, 522, 589, 592, 633, 706, 768. 1897.

Mohr, U. S. Forestry Bull. **31**: 9–12; Contr. U. S. Nat. Herb. **6**: 81, 82, 102, 108, 133, 326. 1901. (General.)

Kocher & Westover, Field Operations U. S. Bureau of Soils **1907**: 458. (On limestone, Butler Co.)

Harper, Bull Torr. Club **37**: 114. 1910. (Bluffs on Warrior River.)

Smith & Pace, Field Operations U. S. Bureau of Soils **1908**, 757, 768. (Flatwoods and limestone areas, Jefferson Co.)

ARKANSAS

Loughridge, Tenth Census U. S. **5**: 569, 573, 629. 1884. (Quoted from Lesquereux).

J. F. Williams, Rep. Geol. Surv. Ark. **1890**[2]: 170. 1891. (Magnet Cove.)

CONNECTICUT

Bissell & Andrews, Fl. Southington 10. 1902. (Rocky hills.)

W. E. Britton, Bull. Torr. Club **30**: 578, 581, 619. 1903. (Sand-plains.)

DELAWARE

Sargent, Tenth Census U. S. **9**: 511. 1884. (Northern portion.)

L. M. Snow, Bot. Gaz. **34**: 294, 296, 301, 303, 305. 1902. (Dunes.)

FLORIDA

Garber, Bot. Gaz. **2**: 112–113. 1877. (Cedar Keys.)

Curtiss, Bot. Gaz. **4**: 133. 1879. (Shell Islands.)

E. A. Smith, Tenth Census U. S. **6**: 204, 238. 1884(?). (High hammocks.)

Curtiss, Tenth Census U. S. **9**: 522. 1884. (General.)

B. Torrey, Atlantic Monthly **72**: 602. 1893. (Reprinted in his Florida Sketch-book 90–91. 1894.)

Mohr, U. S. Forestry Bull. **31**: 12, 15, 23. 1901.

Harper, Ann. Rep. Fla. Geol. Surv. **3**: 237–239, 241, 243, 352. 1911. (Swamps.) Bull. Torr. Club **38**: 231, 235. 1911. (Swamps north of Jacksonville.)

GEORGIA

Loughridge, Tenth Census U. S. **6**: 318. 1884(?).

Harper, Bull. Torr. Club **27**: 425. 1900 (along Flint River); **28**: 475. 1901. (On limestone in N. W. Ga.)

T. L. Watson, Bull. Geol. Surv. Ga. **9A**: 80, 112, 128, 136, 141, 234. 1902. (On granite outcrops in Middle Ga.)

Harper, Bull. Torr. Club **38**: 229, 235. 1911. (Borders of marshes.)

ILLINOIS

Cowles, Bot. Gaz. **31**: 166, 168. 1901. (Bluffs on Lake Michigan.)

Gleason, Bull. Ill. State Lab. Nat. Hist. **9**: 145, 147. 1910. (Along rivers.)

INDIANA

S. Coulter, Forest Trees of Ind. 31–32. 1892. (General.)

E. J. Hill, Garden & Forest **9**: 373. 1896. (Dunes of Lake Michigan.)

S. Coulter, Rep. State Geol. Ind. **24**: 618. 1901. (General.)

IOWA

Fink, Proc. Ia. Acad. Sci. **4**: 102. 1897. (Tops of wooded bluffs, Fayette Co.)

J. E. Cameron, Ia. Geol. Surv. **8**: 199. 1898. (Hills and bluffs, Delaware Co.)

Macbride, Ia. Geol. Surv. **10**: 650. 1900. (Rocky hills, Dubuque Co.)

H. A. Mueller, Proc. Ia. Acad. Sci. **8**: 204. 1901; **11**: 297. 1904. (Hillsides and bluffs, Madison Co.)

R. I. Cratty, Proc. Ia. Acad. Sci. **11**: 297. 1904. (High banks of lakes, Emmet Co.)

M. E. Peck, Proc. Ia. Acad. Sci. **12**: 194. 1905. (Mostly on high rocky banks of Iowa River, Hardin Co.)

Shimek, Ia. Geol. Surv. **16**: 154, 165. 1906. (Rocky slopes, etc., Winneshiek Co.)

Kansas

S. C. Mason, Garden and Forest **3**: 583. 1890. (General.) 8th Bien. Rep. Kan. State Bd. Agric. 273. 1893. (Rocky limestone bluffs.)

A. S. Hitchcock, Trans. Acad. Sci. St. Louis **8**: 61. 1898. (Limestone hills.)

R. S. Kellogg, U. S. Forest Service Bull. **66**: 12, 18–20, 23–25, 34. 1905. (Western portion.)

Kentucky

Shaler, Repts. of Progress Geol. Surv. Ky. (n. s.) **3**: 104, 425. 1877.

L. H. DeFriese, ibid. **5**: 61, 293, 310, 313, 321. 1880.

W. M. Linney, ibid. **5**: 356, 365. 1880; Rep. on botany of Madison, Lincoln, Garrard, Washington and Marion Cos. 10, 11, 14, 21. 1883(?).

H. A. Evans, Bot. Gaz. **14**: 311, 314. 1889. (Limestone.)

Rice & Geib, Field Operations U. S. Bureau of Soils **1904**: 538. (Limestone areas, Warren Co.)

Louisiana

Hilgard, Soils 512. 1906. (Calcareous areas.)

Maryland

Shreve, Chrysler & Blodgett, Plant Life of Md. 144, 155, 161, 187–189, 202, 214, 252, 393. 1910. (Shores, fence-rows, serpentine barrens, cliffs, etc.)

Massachusetts

Emerson, Rep. on Trees and Shrubs of Mass. 102. 1846. (General.)

Blankinship, Rhodora **5**: 128. 1903. (Hill-top barrens.)

Sears, Geol. Essex Co. 39, 40. 1906. (On diorite, augite-syenite, and lime-slate, never on hornblende granite.)

Bicknell, Bull. Torr. Club **35**: 58. 1908. (Nantucket.)

F. S. Collins, Rhodora **12**: 9. 1910. (Cape Cod.)

Michigan

Emma J. Cole, Grand Rapids Flora 7. 1901.

Beal, Rep. Mich. Acad. Sci. **5**: 40. 1904. (General.)

F. B. H. Brown, Bot. Gaz. **40**: 275, 276, 279, 282. 1905.

C. A. Davis, Rep. Geol. Surv. Mich. **1906**: 151. 1907. (Bottom of a lake dry for a few years.)

Minnesota

Upham, Rep. Geol. & Nat. Hist. Surv. Minn. **12**^{6}: 134. 1884. (General.)

W. A. Wheeler, Minn. Bot. Stud. **2**: 366, 372. 1900. (Dry bluffs, S.E. portion.)

Mississippi

Hilgard, Geol. & Agric. Miss. 373. 1860. (Shell hammocks on coast.) Tenth Census U. S. **5**: 215. 1884(?). (Cretaceous prairie region.) Soils 490, 491, 499, 505. 1906. (Calcareous regions.)

Lloyd & Tracy, Bull. Torr. Club **28**: 84. 1901. (Cat Island.)

Missouri

Loughridge, Tenth Census U. S. **5**: 507. 1884(?). (Cherty slopes.)

Bush, Ann. Rep. Hort. Soc. Mo. **37**: 356. 1895. (General.)

Mackenzie & Bush, Fl. Jackson Co. 7. 1902.

Daniels, Fl. Columbia and vicinity 15, 48, 60, 82. 1907. (Cliffs, etc.)

Nebraska

Pound & Clements, Phytogeog. Neb. (ed. 2), 326, 334, 339, 343. 1900.

New Jersey

Hollick, Am. Nat. **33**: 5, 8. 1899; Report on Forests 185, 187. 1900. (Cretaceous region.)

Gifford, Report on Forests 251, 252, 284. 1900. (Dunes.)

Harshberger, Proc. Acad. Nat. Sci. Phila. **1900**: 646–651; **1902**: 648, 653, 655, 658; Forest Leaves **9**: 40. 1903. (Along coast.)

Stone, Proc. Acad. Nat. Sci. Phila. **1907**: 456. 1908. (Outside of pine-barrens.)

Harshberger, Torreya **10**: 9. 1910. (Navesink Highlands.) Phytogeog. Surv. N. A. 222, 413, 414, 416, 417, 425, 461, *pl. 4, f. 23, 24.* 1911. (Dunes mostly.)

Stone, Ann. Rep. N. J. State Mus. **1910**: 86, 89–91, 145, 153. 1912. (General.)

New York

Torrey, Fl. N. Y. **2**: 235. 1843. (General.)

Paine, Cat. Pl. Oneida Co. 78. 1865. (Rocky hills, etc.)

Day, Cat. Pl. Buffalo and vicinity, 72. 1883. (Rare.)

Dudley, Cayuga Flora 131. 1886. (Rocky banks, etc.)

Beckwith & Macauley, Proc. Rochester Acad. Sci. **3**: 130. 1896. (River-banks, etc., Monroe Co., rare.)

Clute, Fl. Upper Susquehanna 102. 1898.

Davenport, Science II. **8**: 688. 1898. (Beaches, northwestern L. I.)

Hollick, Torreya **6**: 214. 1906. (Borders of marshes, Staten Island.)

Taylor, Bull. N. Y. Bot. Gard. **7**: 96. 1909. (General.)

North Carolina

Kerr, Tenth Census **6**: 545. 1884. (Sea-islands.)

W. F. Massey, Garden and Forest **5**: 189. 1892. (Smith's Island.)

Ashe, Bull. N. C. Geol. Surv. **5**: 15, 26. 1894.

Pinchot & Ashe, Bull. N. C. Geol. Surv. **6**: 121. 1898. (General.)

Kearney, Contr. U. S. Nat. Herb. **5**: 271. 1900. (Ocracoke Island.)

D. S. Johnson, Bot. Gaz. **30**: 406, 407. 1900. (Dunes, etc., near Beaufort.)

Dorsey & others, Field Operations U. S. Bureau of Soils **1901**: 275. (Iredell Co.)

House, Torreya **10**: 31, 34. 1910. (Granite peaks, Transylvania Co.)

Ohio

Moseley, O. State Acad. Sci. Special Papers **1**: 39. 1889.

Jennings, Ohio Nat. **8**: 299–301, 321–326. 1908. (Dunes of Lake Erie.)

Pennsylvania

Harshberger, Bull. Torr. Club **24**: 180. 1897; Science II. **18**: 340–342. 1903. (Serpentine barrens.)

Harshberger, Bull. Torr. Club **31**: 143, 145. 1904. (Rocky places in S.E. portion.)
Wilder & others, Field Operations U. S. Bureau of Soils **1905**: 149. (Serpentine barrens, Chester Co.)
Jennings, Ann. Carnegie Mus. **5**: 302, 319–321, 323, 334, 336, 341, 403. 1909. (Dunes of Lake Erie.)
Harshberger, Bull. Torr. Club **36**: 653, 656, 663, 664, 668, 670. 1909. (Nockamixon Rocks.)
Pennell, Proc. Acad. Nat. Sci. Phila. **1910**: 546, 550. (Serpentine barrens.)
Harshberger, Phytogeog. Surv. N. A. 468, 470, 474, 502. 1911.

South Carolina

Coker, Torreya **5**: 141–144. 1905. (Isle of Palms.)

Tennessee

Safford, Am. Jour. Sci. **62**: 354, 357, with plate. 1851. (Cedar-glades.) Geol. Tenn. 100, 106, 107, 233, 234, 245, 260, 262, 263, 266, 267. 1869.
Killebrew & Safford, Introd. Resources of Tenn. 36, 74–75, 476, 627, 639, 818–819, 830, 833, 975, 993, 1009–1010. 1874.
Safford, Tenth Census U. S. **5**: 400–401, 405, 455, 456, 458, 459, 461. 1884. (Cedar-glades of Middle Tenn.)
Sargent, Tenth Census U. S. **9**: 544. 1884. (Cedar-glades of Middle Tenn.)
Sudworth & Killebrew, Forests of Tenn. 6–7. 1897. (Middle Tenn.)
Mohr, U. S. Forestry Bull. **31**: 13–14. 1901. (Middle Tenn.)
Gattinger, Fl. Tenn. (ed. 2), 22, 32. 1901. (Cedar-glades mostly.)
Ayrs & Gray, Field Operations U. S. Bureau of Soils **1907**: 788–789. (Cedar-glades, Giles Co.)
R. C. Hall, Tenn. Geol. Surv. Bull. **10A**: 28, 29, 36. 1910. (General.)

Texas

Bray, U. S. Forestry Bull. **47**: 54. 1904.

Vermont

Anna M. Clark, Vt. Exp. Sta. Bull. **73**: 45–46. 1899. (Dry rocky hills.)
Brainerd, Jones & Eggleston, Fl. Vt. 5. 1900. (Dry rocky hills.)

Virginia

Kearney, Contr. U. S. Nat. Herb. **5**: 378, 405, 407. 1901. (Dunes, bluffs, and roadsides in S.E. portion.)
Harshberger, Forest Leaves **9**: 44. 1903. (Edge of gorge at Natural Bridge.)

Wisconsin

Pammel, Garden and Forest **4**: 532. 1891. (Sandy bottoms, limestone rocks, etc.)

KEY TO THE WILD AND CULTIVATED TREES IN AUTUMN*

By Chester Arthur Darling

1 *a*. Leaves about 1/8 in. or less broad, often evergreen....................2.
b. Leaves more than 1/4 in. broad....................................34.
2 *a*. Leaves scale-like, more or less appressed to the stem, the tips sometimes spreading..3.
b. Leaves awl-shaped, linear, or needle-like, not appressed to the stem.....6.
3 *a*. Branchlets appear more or less 4-sided, not flattened laterally; all leaves more or less keeled.............**Red Cedar.** (*Juniperus virginiana.*)
b. Branchlets appear much flattened laterally, two rows of leaves flat and two rows keeled or ridged...4.
4 *a*. Branchlets about 1/16 in. broad, the flat leaves with a discoid marking on the back...........**Southern White Cedar.** (*Chamaecyparis thyoides.*)
b. Branchlets about 1/6 in. broad......................................5.
5 *a*. Branchlets lighter colored beneath....**Arbor Vitae.** (*Thuja occidentalis.*)
b. Branchlets alike on both sides. **Oriental Arbor Vitae.** (*Thuja orientalis.*)
6 *a*. Leaves in clusters on the stem......................................7.
b. Leaves attached singly to the stem..................................20.
7 *a*. Leaves 2–5 in a cluster...8.
b. Leaves 10 or more in a cluster......................................17.
8 *a*. Leaves in clusters of 5, or some in 4's.............................9.
b. Leaves in clusters of 2 or 3..11.
9 *a*. Leaves 5–8 in. long, drooping, the young branches whitish; cultivated tree. **Bhotan Pine.** (*Pinus excelsa.*)
b. Leaves 2–5 in. long, not drooping, young branches not whitish..........10.
10 *a*. Young branches covered with brownish hairs; mature cones 2–4 in. long; cultivated tree..................**Swiss Stone Pine.** (*Pinus cembra.*)
b. Young branches not covered with brownish hairs; mature cones 3–6 in. long; native tree, often planted...........**White Pine.** (*Pinus Strobus.*)
11 *a*. Leaves in clusters of 3..12.
b. Leaves in clusters of 2, or some in 3's............................13.
12 *a*. Cultivated tree; mature cones 4–6 in. long. **Western Yellow Pine.** (*Pinus ponderosa.*)
b. Native tree; mature cones 2–3 in. long...**Pitch Pine.** (*Pinus rigida.*)
13 *a*. Average leaf less than 4 in long...................................14.
b. Average leaf 4 in. or more long....................................15.

* This key is designed to be used in the field to determine the trees to be found growing in the eastern United States. In using the key begin with No. 1, read both *a* and *b* and choose the one which fits the specimen; follow the key as indicated by the number to which you are referred each time, reading both *a* and *b* until the name of the specimen is obtained. Accuracy in observation and in following the key are of first importance, choosing an average specimen is likewise important. Additional copies of this key may be had for 10 cents by addressing the author at Columbia University, New York City.

14 *a*. Leaves 1–3 in. long, dark green; native tree.
Jersey Pine. (*Pinus virginiana.*)
b. Leaves about 3 in. long, twisted, rather light green; cultivated tree.
Scotch Pine. (*Pinus sylvestris.*)
15 *a*. Cultivated tree; leaves much clustered at the ends of the branches; mature cones 2–3 in. long................**Austrian Pine.** (*Pinus austriaca.*)
b. Native tree; leaves not noticeably clustered at the ends of the branches; mature cones 1–2 in. long....................................16.
16 *a*. Some leaves on the branch in clusters of 3, others in 2's.
Yellow Pine. (*Pinus echinata.*)
b. All leaves in clusters of 2..................**Red Pine.** (*Pinus resinosa.*)
17 *a*. Leaves deciduous, borne on short bud-like branches..................18.
b. Leaves evergreen, not borne on short bud-like branches..............19.
18 *a*. Leaves about 3/4 in. long; mature cones about 1/2 in. long; native tree.
Tamarack. (*Larix laricina.*)
b. Leaves about 1 in. long; mature cones about 1 in. long; cultivated tree.
European Larch. (*Larix decidua.*)
19 *a*. Leaves 1/2–3/4 in. long; mature cones 2–3 in. long.
African Cedar. (*Cedrus Atlantica.*)
b. Leaves 1–3 in. long; mature cones 3–5 in. long.
Cedar-of-Lebanon. (*Cedrus Libani.*)
20 *a*. Leaves 3–6 in. long, in whorls at the ends of the branches; small cultivated tree.......................**Umbrella Pine.** (*Sciadopitys verticillata.*)
b. Leaves 2 in. or less long...21.
21 *a*. Each leaf extends down the stem, not jointed to it; leaves awl-shaped, rigid; small cultivated tree........**Japanese Cedar.** (*Cryptomeria japonica.*)
b. Trees not completely as in *a*......................................22.
22 *a*. Leaves thick, somewhat 4-sided; branches very rough when leaves are removed..23.
b. Trees not completely as in *a*......................................26.
23 *a*. Leaves 1/4–1/2 in. long, crowded, appressed to the branches.
Oriental Spruce. (*Picea orientale.*)
b. Leaves 1/2–1 in. long, not appressed to the branches...............24.
24 *a*. Leaves bluish or whitish, strongly incurved on the upper branches.
Blue Spruce. (*Picea pungens.*)
b. Leaves not completely as in *a*....................................25.
25 *a*. Leaves usually 3/4–1 in. long; mature cones 4–6 in. long; cultivated tree.
Norway Spruce. (*Picea Abies.*)
b. Leaves usually 1/2 in. long; mature cones 1–2 in. long; native tree.
Black Spruce. (*Picea Mariana.*)
26 *a*. Leaves rigid, tapering to the apex; some leaves usually scale-like.
Red Cedar. (*Juniperus virginiana.*)
b. Leaves not completely as in *a*....................................27.
27 *a*. Leaves deciduous, appearing only on the present year's branches; the young branches often deciduous............**Cypress.** (*Taxodium distichum.*)
b. Leaves evergreen, appearing on 2-year old branches ....28.
28 *a*. Branches covered with small projections to which the leaves are attached..29.
b. Branches without projections, rather smooth when leaves are removed.30.

29 *a*. Leaves blunt at apex, about 1/2 in. long, with two white lines beneath when fresh .... **Hemlock.** (*Tsuga canadensis.*)
b. Leaves somewhat pointed at apex, 3/4–1 in. long.
European Yew. (*Taxus baccata.*)
30 *a*. Leaves pointed at the apex.. **Cephalonian Silver Fir.** (*Abies cephalonica.*)
b. Leaves blunt or notched at the apex ....31.
31 *a*. Leaves blue-green, usually glaucous on the young shoots, often 4-sided.
Red Fir. (*Abies nobilis.*)
b. Leaves dark green and shining above, whitish beneath ....32.
32 *a*. Native tree; leaves about 3/4 in. long; mature cones 2–4 in. long.
Balsam Fir. (*Abies balsamea.*)
b. Cultivated trees; average leaves usually more than 3/4 in. long; mature cones 4–6 in. long...33.
33 *a*. Leaves tapering to the base, somewhat curved.
Northern Silver Fir. (*Abies nordmanniana.*)
b. Leaves not completely as in *a*................**Silver Fir.** (*Abies Picea.*)
34 *a*. Leaves or leaf scars opposite on the branch..........................35.
b. Leaves or leaf scars alternate on the branch........................58.
35 *a*. Leaves simple..36.
b. Leaves compound..50.
36 *a*. Leaves with entire or wavy margin.....................................37.
b. Leaves with toothed or lobed margins.................................40.
37 *a*. Leaves ovate, 2–5 in. long; small tree with bark peeling off in small rectangular patches...............**Flowering Dogwood.** (*Cornus florida.*)
b. Leaves broadly ovate; trees with rather smooth or flaky bark..........38.
38 *a*. Leaves 2–3 in. long with wavy margins; cultivated tree.
Cercidiphyllum. (*Cercidiphyllum japonicum.*)
b. Leaves 6–12 in. long with entire margins............................39.
39 *a*. Fruit of long pods 8–20 in. long.............**Catalpa.** (*Catalpa Catalpa.*)
b. Fruit of short capsules 1–2 in. long...**Empress Tree.** (*Paulownia tomentosa.*)
40 *a*. Leaves sharply toothed, not lobed, the teeth about 1/4 in. long; cultivated tree........................**Hornbeam Maple.** (*Acer carpinifolium.*)
b. Leaves more or less lobed...41.
41 *a*. Leaves very deeply 7–11-lobed, the lobes linear to lanceolate, narrow, sometimes relobed; cultivated tree..... **Japanese Maple.** (*Acer palmatum.*)
b. Leaves not completely as in *a*.....................................42.
42 *a*. Leaves nearly circular in outline, 5–9-lobed, the lobes doubly toothed; cultivated tree.............**Round-leaved Maple.** (*Acer circinatum.*)
b. Leaves not completely as in *a*.....................................43.
43 *a*. Leaves 3-lobed only toward the apex, the margins finely toothed all around; bark smooth, green, striped.....**Striped Maple.** (*Acer pennsylvanicum.*)
b. Leaves and bark not completely as in *a*...........................44.
44 *a*. Leaves with indentations extending more than half way to the petiole, whitish beneath; bark peeling off in thin flakes; branches often upturned at the ends.......................**Silver Maple.** (*Acer saccharinum.*)
b. Trees not completely as in *a*......................................45.
45 *a*. Leaves 3–7-lobed, the lobes entire or the middle one sometimes slightly toothed; cultivated trees...46.

b. Leaves with lobes more or less toothed or relobed....................47.

46 *a.* Branches corky; leaves 3–5-lobed, the lobes blunt at apex.
English Maple. (*Acer campestre.*)

b. Branches not corky; leaves 5–7-lobed, the lobes pointed.
Colchicum-leaved Maple. (*Acer laetum.*)

47 *a.* Leaves usually 3-lobed, the lobes toothed; petiole and twigs usually red; bark usually smooth and light gray, usually rough only toward the base.
Red Maple. (*Acer rubrum.*)

b. Trees not completely as in *a*....................................48.

48 *a.* Lobes of leaves many-toothed, the teeth usually rounded, not with bristly tips......................**Sycamore Maple.** (*Acer pseudo-platanus.*)

b. Lobes of leaves with 2–4 coarse teeth, the teeth usually pointed or with bristly tips...49.

49 *a.* Cultivated tree; leaves 4–7 in. broad; bark smooth or short-furrowed.
Norway Maple. (*Acer platanoides.*)

b. Native tree; leaves 3–6 in. broad; bark peeling in elongated flakes.
Sugar Maple. (*Acer Saccharum.*)

50 *a.* Leaves palmately compound...51.

b. Leaves pinnately compound...52.

51 *a.* Fruit prickly; tree rather commonly planted.
Horse-chestnut. (*Aesculus Hippocastanum.*)

b. Fruit not prickly; tree not very commonly planted.
Ohio Buckeye. (*Aesculus glabra.*)

52 *a.* Leaflets 3 or 5, coarsely toothed or lobed...**Box Elder.** (*Acer Negundo.*)

b. Leaflets 7 or more...53.

53 *a.* Fruit berry-like; bark corky.....**Cork Tree.** (*Phellodendron amurense.*)

b. Fruit winged; bark not corky.......................................54.

54 *a.* Lateral leaflets stalked...55.

b. Lateral leaflets not stalked.......................................56.

55 *a.* Fruit with wing nearly all terminal on the seed.
White Ash. (*Fraxinus americana.*)

b. Fruit with wing extending about half way down on the seed.
Red Ash. (*Fraxinus pennsylvanica.*)

56 *a.* Trees growing wild, in moist places.......**Black Ash.** (*Fraxinus nigra.*)

b. Cultivated trees...57.

57 *a.* Fruit 3/4–1 in. long; leaflets usually entire.
Flowering Ash. (*Fraxinus ornus.*)

b. Fruit 1–2 in. long; leaflets usually toothed.
English Ash. (*Fraxinus excelsior.*)

58 *a.* Leaves compound, composed of 3 or more leaflets....................59.

b. Leaves simple..75.

59 *a.* Leaflets usually 2 in. or less long, with entire margins; fruit a pod.....60.

b. Some or all of the leaflets more than 2 in. long, with entire or toothed margins..63.

60 *a.* Trees usually with thorns 1 in. or more long on the trunk; leaves usually doubly compound; pods 10 in. or more long, flat.
Thorny Locust. (*Gleditsia triacanthos.*)

b. Trees not completely as in *a*....................................61.

61 *a*. Leaves doubly compound; pods 6–10 in. long.
Coffee-tree. (*Gymnocladus dioica.*)
b. Leaves singly compound; pods 6 in. or less long....................62.
62 *a*. Usually short spines at the base of the petiole in place of stipules; branches zigzag; pods about 4 in. long; bark with long furrows.
Black Locust. (*Robinia pseudacacia*).
b. No spines at base of leaves as in *a*; cultivated tree.
Pagoda Tree. (*Sophora japonica.*)
63 *a*. Leaflets with entire margins; cultivated tree.
Yellow-wood. (*Cladrastis lutea.*)
b. Leaflets with margins more or less toothed or incised.................64.
64 *a*. Leaflets with only 2–8 teeth at the base; fruit winged.
Ailanthus. (*Ailanthus glandulosa.*)
b. Leaflets not completely as in *a*....................................65.
65 *a*. Leaflets irregularly toothed or incised; cultivated tree.
Varnish Tree. (*Koelreuteria paniculata.*)
b. Leaflets more or less regularly toothed..............................66.
66 *a*. Leaflets toothed towards the apex, usually less than 1 in. broad; fruit of red berries.........................**Mountain Ash.** (*Sorbus americana.*)
b. Leaflets usually toothed all around; fruit of nuts....................67.
67 *a*. Leaflets 13–25 to each leaf...68.
b. Leaflets 5–11..70.
68 *a*. Cultivated tree; nuts with wings about 3/4 in. broad.
Caucasian Walnut. (*Pterocarya fraxinifolia.*)
b. Native trees; nuts not winged...69.
69 *a*. Leaflets with sticky hairs; nut oblong.....**Butternut.** (*Juglans cinerea.*)
b. Leaflets not with sticky hairs; nut globose...**Black Walnut.** (*Juglans nigra.*)
70 *a*. Cultivated tree; shuck of nut not splitting.
English Walnut. (*Juglans regia.*)
b. Native trees; shuck splitting from the nut............................71.
71 *a*. Bark of trunk shaggy in older trees; leaflets usually 5...............72.
b. Bark not shaggy; leaflets 5–11...73.
72 *a*. Nut about 3/4 in. or more broad; shuck comparatively thick; common tree.
Shagbark Hickory. (*Hicoria ovata.*)
b. Nut less than 3/4 in. broad; shuck comparatively thin; tree not common.
Small-fruited Hickory. (*Hicoria microcarpa.*)
73 *a*. Terminal bud yellowish, without thin scales; leaflets 7–11.
Bitternut Hickory. (*Hicoria minima.*)
b. Terminal bud not yellowish, with thin scales; leaflets 5–9...............74
74 *a*. Twigs covered with hairs just back of the terminal bud; leaflets usually 7; shuck of nut comparatively thick..........**Mockernut.** (*Hicoria alba.*)
b. Twigs not covered with hairs as in *a*; leaflets usually 5; shuck of nut thin.
Pignut. (*Hicoria glabra.*)
75 *a*. Trees with light colored patches on the upper trunk and branches where bark has peeled; fruit globose with stems 2 in. or more long...............76.
b. Tress not completely as in *a*...77.
76 *a*. Fruit in clusters of 2 or more...**Oriental Sycamore.** (*Platanus orientalis.*)
b. Fruit single, not in clusters...**American Sycamore.** (*Platanus occidentalis.*)

77 *a*. Leaves somewhat fan-shaped, the apex usually deeply incised; cultivated tree............................**Maiden-hair Tree.** (*Ginkgo biloba.*)

b. Leaves not completely as in *a*....................................78.

78 *a*. Leaves broadly notched at apex, usually with 2 lateral and 2 basal lobes; fruit cylindrical...**White Wood. Tulip Poplar.** (*Liriodendron tulipifera.*)

b. Leaves not notched at apex, usually pointed..........................79.

79 *a*. Leaves somewhat star-shaped, 5–7-pointed, deep red in autumn; fruit globose, prickly; twigs often with wings of cork.
Sweet Gum. (*Liquidambar styraciflua.*)

b. Leaves not star-shaped...80.

80 *a*. Bark spicy; leaves with 1–3 lobes or some not lobed.
Sassafras. (*Sassafras Sassafras.*)

b. Trees not completely as in *a*....................................81.

81 *a*. Leaves with entire or smooth margins.............................82.

b. Leaves with toothed or lobed margins.............................89.

82 *a*. Small trees usually with thorns on the branches; fruit globose, 2 in. or more in diameter; a milky sap often exudes from cut or broken twigs.
Mock Orange. (*Toxylon pomiferum.*)

b. Trees not completely as in *a*....................................83.

83 *a*. Branches conspicuously massed toward the top of trees, horizontal, often drooping; bark often checkered; leaves usually red in autumn; fruit berry-like...................**Sour Gum. Tulepo.** (*Nyssa sylvatica.*)

b. Trees not completely as in *a*....................................84.

84 *a*. Leaves whitish beneath, rather thick.....**Magnolia.** (*Magnolia virginiana.*)

b. Leaves not whitish beaneath.......................................85.

85 *a*. Leaves 10–24 in. long.........**Umbrella Tree.** (*Magnolia tripetala.*)

b. Leaves 5 in. or less long...86.

86 *a*. Fruit somewhat fluffy, in large panicles, very conspicuous on the small tree.
Smoke Tree. (*Cotinus cotinoides.*)

b. Trees not completely as in *a*....................................87.

87 *a*. Leaves somewhat rounded; fruit a pod..**Judas Tree.** (*Cercis canadensis.*)

b. Leaves oval to lanceolate...88.

88 *a*. Leaves oval; fruit fleshy; bark in patches.
Persimmon. (*Diospyros virginiana.*)

b. Leaves linear-lanceolate; fruit an acorn.
Willow Oak. (*Quercus Phellos.*)

89 *a*. Leaves with margins more or less lobed, with more than 3 lobes; fruit an acorn..90.

b. Leaves usually with toothed margins, sometimes with 2 or 3 lobes; or palmately veined; fruit not an acorn or wanting...................101.

90 *a*. Lobes of leaves more or less pointed or with bristly tips; cup of acorn with comparatively smooth scales on the outside.......................91.

b. Lobes of leaves more or less rounded, not with bristly tips; cup of acorn rough on the outside.......................................95.

91 *a*. Average leaf 3–5 in. long; branches conspicuously horizontal or drooping, and low down on the trunk; acorn about 1/2 in. long.
Pin Oak. (*Quercus palustris.*)

b. Trees not completely as in *a*....................................92.

92 *a*. Leeaves conspicuously wedge-shaped with 3–5 rather short, rounded lobes with bristly tips............**Black-jack Oak.** (*Quercus marylandica.*)
b. Lobes of leaves pointed..93.
93 *a*. Cup of acorn shallow, saucer-shaped, enclosing 1/8–1/4 of the mature acorn; lobes of leaves usually triangular..........**Red Oak.** (*Quercus rubra.*)
b. Cup of acorn encloses about 1/2 of the mature acorn; lobes of leaves not usually triangular..94.
94 *a*. Inner bark yellow or orange and very bitter; scales of cup fringed or reflexed about the top of cup; lobes of leaf often at right angles to the midrib. **Black Oak.** (*Quercus velutina.*)
b. Inner bark not as in *a*; scales of cup usually compressed about the acorn; lobes of leaves often relobed toward outer ends. **Scarlet Oak.** (*Quercus coccinea.*)
95 *a*. Bark on trunk furrowed, dark gray..............................96.
b. Bark on trunk flaky, usually light gray...........................98.
96 *a*. Cup of acorn fringed; leaves usually regularly lobed; cultivated tree. **Turkey Oak.** (*Quercus cerris.*)
b. Cup of acorn not fringed.......................................97.
97 *a*. Native tree; leaves regularly lobed; cup enclosed about 1/4 or less of the acorn; bark with very hard triangular ridges. **Rock Chestnut Oak.** (*Quercus prinus.*)
b. Cultivated tree; leaves variously lobed; cup encloses 1/3 or more of the acorn. **English Oak.** (*Quercus pedunculata.*)
98 *a*. Lobes of leaves short, the indentations about 1/4 the distance to the midrib; bark very loose on the smaller branches; cup with stalk 2–4 in. long. **Swamp White Oak.** (*Quercus platanoides.*)
b. Trees not completely as an *a*....................................99.
99 *a*. Lobes of leaves usually narrow toward the base, often relobed at the apex; leaves usually thick and with brownish hairs beneath. **Post Oak.** (*Quercus minor.*)
b. Leaves not completely as in *a*..................................100.
100 *a*. Cup conspicuously fringed at top, mossy; tree not common. **Bur Oak.** (*Quercus macrocarpa.*)
b. Cup not fringed at top; tree common...**White Oak.** (*Quercus alba.*)
101 *a*. Bark smooth, dark gray, the trunk ridged or sinew-like; fruit with leaf-like wings, in pairs..................**Blue Beech.** (*Carpinus caroliniana.*)
b. Trees not completely as in *a*..................................102.
102 *a*. Bark smooth, light gray, without horizontal markings; terminal bud slender, tapering, 1/2–1 in. long..................................103.
b. Bark and terminal buds not completely as in *a*.....................104.
103 *a*. Leaves hairy beneath, sometimes purplish; cultivated species. **European Beech.** (*Fagus sylvatica.*)
b. Leaves not hairy beneath; native species. **American Beech.** (*Fagus grandifolia.*)
104 *a*. Leaves with margin toothed only toward apex, entire toward the base; fruit berry-like, sweet; bark on trunk often corky at base. **Hackberry.** (*Celtis occidentalis.*)
b. Leaves toothed all around the margin.............................105.

105 *a*. Leaves 5 in. or more long, with very sharply toothed margins; fruit a prickly bur..106.

b. Leaves and fruit not completely as in *a*..........................107.

106 *a*. Native tree; leaves tapering to the apex.
American Chestnut. (*Castanea dentata.*)

b. Cultivated tree; leaves abruptly pointed at apex.
European Chestnut. (*Castanea sativa.*)

107 *a*. Leaves somewhat rounded, often unequal at the base; fruit leaf-like with small globose nutlets attached; buds often reddish and placed to one side of the leaf-scar..108.

b. Trees not completely as in *a*..................................110.

108 *a*. Leaves white-woolly beneath; cultivated tree.
Silver Linden. (*Tilia tomentosa.*)

b. Leaves not white-woolly beneath.................................109.

109 *a*. Cultivated tree; leaves with a tuft of wool in the axils of the veins beneath.
European Linden. (*Tilia vulgaris.*)

b. Native tree; leaves not usually as in *a*.....**Basswood.** (*Tilia americana.*)

110 *a*. Bark on trunk peels off in elongated, rather regular vertical strips; fruit hop-like...............................**Ironwood.** (*Ostrya virginiana.*)

b. Bark and fruit not completely as in *a*............................111.

111 *a*. Leaves usually irregularly and deeply toothed or lobed; palmately veined; thorns usually present on the branches; fruit somewhat fleshy.....112.

b. Trees not completely as in *a*....................................119.

112 *a*. Thorns more or less curved; leaves broadly ovate, doubly toothed.....113.

b. Thorns straight; leaves obovate or ovate..........................115.

113 *a*. Lower surface of leaves densely hairy; fruit with hairy stalks.
Red-fruited Thorn. (*Crataegus mollis.*)

b. Lower surface of leaves not densely hairy..........................114.

114 *a*. Leaves rounded or heart-shaped at base.
Washington Thorn. (*Crataegus cordata.*)

b. Leaves usually tapering at the base.
Pruinose Thorn. (*Crataegus pruinosa.*)

115 *a*. Thorns 1/2 in. or less long; leaves ovate, 3–15-lobed or cleft; cultivated tree.
English Hawthorn. (*Crataegus oxyacantha.*)

b. Thorns 3/4 in. or more long.......................................116.

116 *a*. Fruit solitary or 2–3 together, yellow when ripe; margin of leaves with broad teeth..........................**Dwarf Thorn.** (*Crataegus uniflora.*)

b. Fruit 3 or more together, usually red when ripe.....................117.

117 *a*. Leaves usually shining above, not doubly toothed; stalks of fruit not hairy.
Cockspur Thorn. (*Crataegus crus-galli.*)

b. Leaves not shining above, usually doubly toothed; stalks of fruit hairy..118.

118 *a*. Fruit about 1/2 in. in diameter, reddish-brown when ripe; leaves lobed.
Red Haw. (*Crataegus coccinea.*)

b. Fruit 1/2–1 in. in diameter, yellow or red when ripe; leaves not usually lobed.
Large-fruited Thorn. (*Crataegus punctata.*)

119 *a*. Bark on trunk and on branches with horizontal markings usually 1/2 in. or more long, ususally 1/4 in. or less broad; bark not with regular longitudinal furrows..120.

b. Bark not completely as in *a*....................................127.
120 *a*. Leaves triangular in shape....................................121.
b. Leaves rather ovate to oblong in shape..........................122.
121 *a*. Bark close on trunk not in loose sheets; native tree.
Gray Birch. (*Betula populifolia.*)
b. Bark in rather loose sheets on the trunk; cultivated tree.
European White Birch. (*Betula alba.*)
122 *a*. Bark creamy white, in rather loose sheets on the trunk of older trees.
Paper Birch. (*Betula papyrifera.*)
b. Bark yellowish, gray, or brown, not whitish........................123.
123 *a*. Bark yellowish, in rather thin loose sheets on the trunk.
Yellow Birch. (*Betula lutea.*)
b. Bark not yellowish...124.
124 *a*. Fruit usually present on the tree, consisting of hard or woody aments; short twigs present on the branches; bark of twigs not bitter; leaves rather ovate..125.
b. Fruit not present; bark of twigs bitter............................126.
125 *a*. Bark greenish-brown to reddish, in thin loose layers; bark not usually sweet nor aromatic; trees usually growing in damp places.
Red Birch. (*Betula nigra.*)
b. Bark dark-brown or ashy-gray, close on the trunk or peeling in flakes or plates; bark sweet and aromatic; common tree in rather dry places.
Sweet Birch. (*Betula lenta.*)
126 *a*. Leaves mostly oblong, teeth on margin usually incurved; often brownish hairs along the midvein beneath...**Black Cherry.** (*Prunus serotina.*)
b. Leaves mostly obovate; teeth on margin somewhat spreading, usually pointed.........................**Choke Cherry.** (*Prunus virginiana.*)
127 *a*. Leaves with all secondary veins parallel, prominent and oblique to the midrib.
128.
b. Leaves not with secondary veins parallel as in *a*...................131.
128 *a*. Fruit cone-like; leaves with the blade equal at the base.
European Alder. (*Alnus glutinosa.*)
b. Fruit always wanting; leaves with blade usually unequal at the base; outer bark often somewhat corky....................................129.
129 *a*. Leaves not noticeably rough above; buds not hairy.
American Elm. (*Ulmus americana.*)
b. Leaves rough on upper surface; buds hairy.......................130.
130 *a*. Native tree; upper branches drooping and slender; tree usually growing in moist places........................**Slippery Elm.** (*Ulmus fulva.*)
b. Cultivated tree; upper branches ascending or horizontal, rather coarse.
English Elm. (*Ulmus campestris.*)
131 *a*. Leaves usually not more than twice as long as broad; lateral buds with numerous scales..132.
b. Leaves usually more than twice as long as broad; lateral buds with a single scale...141.
132 *a*. Petioles of leaves flattened laterally...........................133.
b. Petioles of leaves not flattened laterally........................136.
133 *a*. Leaves white-woolly beneath and lobed...**White Poplar.** (*Populus alba.*)
b. Leaves not completely as in *a*..................................134.

134 *a*. Leaves more or less triangular in shape.............................135.
b. Leaves not triangular...136.
135 *a*. Leaves 2–3 in. broad, branches erect or ascending.
Lombardy Poplar. (*Populus italica.*)
b. Leaves 3–7 in. broad; branches more or less spreading.
Cottonwood. (*Populus deltoides.*)
136 *a*. Terminal bud about 1/2 in. or more long, usually pointed...........137.
b. Terminal bud 1/4 in. or less long, usually rounded...................138.
137 *a*. Leaves ovate, the margins usually with large irregular teeth 1/8 in. or more long...................**Large-toothed Aspen.** (*Populus grandidentata.*)
b. Leaves round-heart-shaped, 1–3 in. broad, the margin with rather small regular teeth usually less than 1/8 in. long.
American Aspen. (*Populus tremuloides.*)
138 *a*. Leaves fragrant when crushed, not densely hairy when young, the apex usually tapering................**Balm-of-Gilead.** (*Populus candicans.*)
b. Leaves not fragrant when crushed, densely hairy when young, the apex blunt, the basal lobes often overlapping.
Downy Poplar. (*Populus heterophylla.*)
139 *a*. Branches densely hairy; bark on trunk usually spotted.
Paper Mulberry. (*Broussonetia papyrifera.*)
b. Branches not hairy; bark not spotted............................140.
140 *a*. Mature leaves dull green on upper surface, often rough.
Red Mulberry. (*Morus rubra.*)
b. Mature leaves usually shining and smooth on upper surface.
White Mulberry. (*Morus alba.*)
141 *a*. Mature leaves shining on both sides, not hairy, ovate to lanceolate; twigs shining..............................**Shining Willow.** (*Salix lucida.*)
b. Mature leaves not shining on both sides...........................142.
142 *a*. Leaves green on both sides, not conspicuously lighter colored beneath; branchlets pale yellow; leaves 1/4–3/4 in. broad, narrowly lanceolate.
Black Willow. (*Salix nigra.*)
b. Leaves conspicuously lighter colored beneath......................143.
143 *a*. Leaves 1/4–1/2 in. broad, 3–7 in. long, very pale beneath; twigs slender and drooping.......................**Weeping Willow.** (*Salix babylonica.*)
b. Trees not completely as in *a*......................................144.
144 *a*. Mature leaves 3/4–2 in. broad, very pale beneath.
Pussy Willow. (*Salix discolor.*)
b. Mature leaves 1/2–3/4 in. broad...................................145.
145 *a*. Large trees with twigs usually shining yellow...**White Yellow.** (*Salix alba.*)
b. Slender trees with twigs reddish-green, very brittle at the base.
Crack Willow. (*Salix fragalis.*)

Columbia University

THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Wilbur L. King

(Continued from June Torreya)

CERATOPHYLLACEAE

Ceratophyllum demersum L. In ponds and slow streams. (Porter.)

MAGNOLIACEAE

Liriodendron Tulipifera L. Along Lehigh river; on Calypso Island, Bethlehem.

RANUNCULACEAE

Caltha palustris L. In meadows along Saucon creek near Hellertown.

Trollius laxus Salisb. In swamps. (Porter.)

Coptis trifolia (L.) Salisb. In damp, mossy woods and bogs. (Porter.)

Cimicifuga racemosa (L.) Nutt. In rich woods on Lehigh Mt. near Lehigh University; also along Saucon creek. July 1, 1899.

Aquilegia canadensis L. In shady places on limestone rocks along Monocacy creek several miles north of Bethlehem and in similar situations along the Lehigh river 1 mile east of Bethlehem. May 9, 1896.

Delphinium Ajacis L. In waste places. (Porter.)

Delphinium Consolida L. In waste places, Bethlehem.

Anemone virginiana L. In thickets along Lehigh canal between Bethlehem and Freemansburg. July, 1897.

Anemone canadensis L. Found for a single season (in 1868) on Calypso Island and since extinct. (Reported in Bethlehem Times July 22, 1878.)

Anemone riparia Fernald. On river banks. (Porter.)

Anemone quinquefolia L. In moist woods along Monocacy creek 1½ miles north of Bethlehem. May 1, 1897.

Hepatica Hepatica (L.) Karst. In rich woods, Lehigh Mt.; also 2 miles north of Bethlehem along Monocacy creek. Apr. 24, 1897.

Syndesmon thalictroides (L.) Hoffmg. In woods, Lehigh Mt. April 28, 1896.

Clematis virginiana L. Climbing over bushes in dry soil at Glendon. Aug. 20, 1899.

Atragene americana Sims. A trailing vine. (Porter.)

Ranunculus reptans L. On shores. (Porter.)

Ranunculus abortivus L. In woods and shady places, Bethlehem. April 28, 1897.

Ranunculus recurvatus Poir. In woods on Lehigh Mt. May 22 ,1898.

Ranunculus acris L. In meadows along Monocacy and Saucon creeks; in moist soil along Lehigh canal, Bethlehem. June 5, 1900.

Ranunculus bulbosus L. In fields near Bethlehem. Common. Aug. 18, 1896.

Ranunculus pennsylvanicus L. f. In wet open places. (Porter.)

Ranunculus repens L. In fields and roadsides. (Porter.)

Ranunculus septentrionalis Poir. In swamps along Monocacy creek. May 17, 1897.

Ranunculus hispidus Michx. In copses on Lehigh Mt. at altitude of about 900 feet. May 30, 1898.

Thalictrum dioicum L. In woods on Lehigh Mt.; also along Monocacy creek. April 30, 1896.

Thalictrum purpurascens L. In woodlands. (Porter.)

Thalictrum polygamum Muhl. In moist soil along bank of Lehigh river near South Bethlehem. July 15, 1899.

BERBERIDACEAE

Berberis vulgaris L. In thickets. (Porter.)
Caulophyllum thalictroides (L.) Michx. In woods. (Porter.)
Podophyllum peltatum L. In moist shady soil along Lehigh river 1 mile east of Bethlehem; along Saucon creek.

MENISPERMACEAE

Menispermum canadense L. In thickets, Bethlehem. June 5, 1902.

LAURACEAE

Sassafras Sassafras (L.) Karst. In dry woods, Lehigh Mt. May 6, 1900.
Benzoin Benzoin (L.) Coult. In moist woods, Lehigh Mt. and along Lehigh river east of Bethlehem and along Monocacy creek north of Bethlehem. April 22, 1897.

PAPAVERACEAE

Papaver somniferum L. In waste grounds. (Porter.)
Papaver Rhoeas L. In waste ground along Monocacy creek. Occasionally. June 20, 1901.
Papaver dubium L. In waste and cultivated grounds. (Porter.)
Argemone mexicana L. In waste places. (Porter.)
Sanguinaria canadensis L. In rich woods, Lehigh Mt. near South Bethlehem; along Monocacy creek 2 miles north of Bethlehem. April 28, 1896.
Chelidonium majus L. Along roadsides and waste places about Bethlehem. Common. May 9, 1898.
Glaucium corniculatum Curtis. On African iron ore in grounds of the Bethlehem Steel Co. (E. A. Rau in Bull. Torr. Club **8**: 114. 1881.)
Bicuculla Cucullaria (L.) Millsp. In rich soil in thickets along Lehigh river one mile east of Bethlehem. Local and rare. April 21, 1896.
Fumaria officinalis (L.) In waste places and on ballast. (Porter.)

CRUCIFERAE

Lepidium campestre (L.) R. Br. In waste places, Bethlehem. July 25, 1899.
Lepidium ruderale L. In waste places and along roadsides. (Porter.)
Lepidium virginicum L. Common along roadsides and waste places, Bethlehem.
Sisymbrium officinale (L.) Scop. Common in waste places, Bethlehem. May 23, 1899.
Sisymbrium altissimum L. In waste places, Bethlehem. Rare. July 1, 1899.
Sinapis alba L. In waste places, Bethlehem. July 30, 1904.
Brassica nigra (L.) Koch. In fields and waste places. (Porter.)
Brassica juncea (L.) Cosson. In waste places. (Porter.)
Brassica arvensis (L.) B. S. P. In waste places, Bethlehem.
Brassica campestris L. In cultivated grounds and occasionally in waste places.
Brassica oleracea L. Has been found as an escape. (Porter.)
Raphanus Raphanistrum L. In fields and waste places, Bethlehem.
Raphanus sativus L. Cultivated and occasionally spontaneous in waste places.
Rapistrum rugosum (L.) All. On old road on College Hill, Easton. (Porter.)
Barbarea Barbarea (L.) MacM. In fields and waste places; also in moist ground along Monocacy and Saucon Creeks. May 20, 1897.
Barbarea stricta Andrz. In fields and waste places. (Porter.)
Barbarea praecox (J. E. Smith) R. Br. In waste places. (Porter.)
Roripa sylvestris (L.) Bess. In low grounds and waste places. (Porter.)

RORIPA PALUSTRIS (L.) Bess. In wet soil along bank of Lehigh river, Bethlehem. In fruit July 10, 1899.
RORIPA HISPIDA (Desv.) Britton. In wet places. (Porter.)
RORIPA NASTURTIUM (L.) Rusby. In springs along Saucon creek; in Monocacy creek 2 miles north of Bethlehem. In fruit and flower July 23, 1900.
RORIPA ARMORACIA (L.) A. S. Hitchcock. In moist ground, Bethlehem.
CARDAMINE PENNSYLVANICA Muhl. Along mountain stream near Lehigh University. In fruit and flower May 30, 1900. Altitude 850 feet.
CARDAMINE PARVIFLORA L. On dry rocks. (Porter.)
CARDAMINE FLEXUOSA With. In wet woods, streams, and mountain swamps. (Porter.)
CARDAMINE BULBOSA (Schreb.) B. S. P. In wet meadows along Monocacy creek 1 mile north of Bethlehem. May 13, 1897.
DENTARIA LACINIATA Muhl. In moist or rich woods. (Porter.)
BURSA BURSA-PASTORIS (L.) Britton. Common in fields, roadsides and waste grounds. Bethlehem. May 23, 1899.
CAMELINA MICROCARPA Andrz. In vacant lots and roadsides, Bethlehem. June 1, 1902.
DRABA VERNA L. In fields at Seidersville. April 28. (G. W. Caffrey.)
SOPHIA SOPHIA (L.) Britton. At Bethlehem. June and July. (G. W. Caffrey.)
STENOPHRAGMA THALIANA (L.) Celak. In fields, Bethlehem. April 17, 1898.
ARABIS LYRATA L. In rocky soil one mile east of Bethlehem; also in Allen township. May 9, 1896.
ARABIS HIRSUTA (L.) Scop. In rocky places. (Porter.)
ARABIS LAEVIGATA (Muhl.) Poir. In rocky woods. (Porter.)
ARABIS CANADENSIS L. In woodland along Monocacy creek near Bethlehem.
ARABIS GLABRA (L.) Bernh. In field and rocky places along Delaware river above Easton. (Porter.)
ERYSIMUM REPANDUM L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Torrey Bulletin, Jan., 1892.
ALYSSUM ALYSSOIDES (L.) Gouan. In fields. (Porter.)
KONIGA MARITIMA (L.) R. Br. In waste places, escaped. (Porter.)
HESPERIS MATRONALIS L. In fields and along roadsides. (Porter.)
CONRINGIA ORIENTALIS (L.) Dumort. In waste places, Bethlehem.

RESEDACEAE

RESEDA LUTEA L. On pile of African iron ore on grounds of Bethlehem Steel Co. (E. A. Rau in Bull. Torr. Club **8**: 114. 1881.)

DROSERACEAE

DROSERA ROTUNDIFOLIA L. In bogs and wet sand. (Porter.)

PODOSTEMACEAE

PODOSTEMON CERATOPHYLLUM Michx. In shallow streams. (Porter.)

CRASSULACEAE

SEDUM THELEPHIUM L. In fields and along roadsides. (Porter.)
SEDUM TELEPHIOIDES Michx. In dry soil near Bethlehem.
SEDUM ACRE L. On rocks and along roadsides. (Porter.)
SEDUM TERNATUM Michx. Spreading freely in the Old Moravian cemetery, Bethlehem. May 20, 1899.
PENTHORUM SEDOIDES L. In wet soil along bank of Lehigh river. Bethlehem. July 15, 1899.

SAXIFRAGACEAE

SAXIFRAGA PENNSYLVANICA L. In swamps and on wet banks. (Porter.)
SAXIFRAGA MICRANTHIDIFOLIA (Haw.) B. S. P. In cold brooks, Bethlehem. (Britton & Brown Illus. Flora, Vol. 2, page 174.)

Saxifraga virginiensis Michx. In dry soil along Lehigh river between Bethlehem and Freemansburg. Common. April 30, 1896.
Heuchera americana L. In rocky woods near South Bethlehem. June 20, 1901.
Mitella diphylla L. In rocky woods, Lehigh Mt. April 30, 1896.
Chrysosplenium Americanum Schwein. In wet shady places along mountain streams near Lehigh University. Aug. 18, 1900. Altitude 850 feet.
Parnassia caroliniana Michx. In swamps and low meadows. (Porter.)
Hydrangea arborescens L. In rocky woodland near South Bethlehem.
Philadelphus inodorus L. Escaped from cultivation, Easton. (Porter.)

GROSSULARIACEAE

Ribes oxyacanthoides L. In wet woods and low grounds. (Porter.)
Ribes Uva-crispa L. In dry soil along towpath of Lehigh canal near Bethlehem. May 12, 1902.
Ribes floridum L'Her. In dry soil along towpath near Bethlehem. May 1.
Ribes rubrum L. In cold woods, freely escaping. (Porter.)

HAMAMELIDACEAE

Hamamelis virginiana L. Along Lehigh river near Bethlehem. Oct. 1, 1896.

PLATANACEAE

Platanus occidentalis L. Along banks Lehigh river, Bethlehem to Easton. May 12, 1901.

ROSACEAE

Opulaster opulifolius (L.) Kuntze. Along Lehigh river east of Bethlehem. June 1, 1897.
Spiraea salicifolia L. In woods between Bethlehem and Easton.
Spiraea tomentosa L. In swamps and low grounds. (Porter.)
Porteranthus trifoliatus (L.) Britton. In woods near Wind Gap. June 3, 1890.
Rubus odoratus L. In woods near South Bethlehem. July 15, 1899.
Rubus strigosus Michx. In dry or rocky situations. (Porter.)
Rubus occidentalis L. In thickets along towpath between Bethlehem and Freemansburg. May 20, 1900.
Rubus villosus Ait. In thickest and in dry soil along canal; also at Nazareth. May 27, 1900.
Rubus Randii (Bailey) Rydb. In dry soil. (Porter.)
Rubus hispidus L. In swamps or low grounds. (Porter.)
Rubus Baileyanus Britton. In dry woods and thickets. (Porter.)
Rubus canadensis L. In fields and in dry soil in Lower Saucon and near Bethlehem. May 30, 1899.
Fragaria virginiana Duchesne. In dry soil near Bethlehem. May 8, 1897.
Fragaria vesca L. In fields and roadsides, Bethlehem.
Duchesnea indica (Andr.) Focke. On roadsides, Bethlehem. In fruit and flower Sept. 20, 1902.
Potentilla arguta Pursh. On dry or rocky hillsides along Delaware river at Easton. (Porter.)
Potentilla argentea L. In dry soil along the Delaware river, Easton. (Porter.)
Potentilla monspeliensis L. In fields and waste places, Bethlehem.
Potentilla canadensis L. In dry soil, Bethlehem. May 13, 1897.
Potentilla pumila Poir. In poor soil. (Porter.)
Waldsteinia fragarioides (Michx.) Tratt. Wooded and shaded hillsides. (Porter.)
Geum canadense Jacq. In thickets and shaded places, Bethlehem. July 10, 1899.
Geum virginianum L. In low grounds. (Porter.)

Geum flavum (Porter) Bicknell. In woods. (Porter.)
Geum strictum Ait. In swamps or low grounds. (Porter.)
Agrimonia hirsuta (Muhl.) Bicknell. In woods near South Bethlehem.
Agrimonia mollis (T. & G.) Britton. Dry woods and thickets. (Porter.)
Agrimonia Brittoniana Bicknell. Along thickets and roadsides. (Porter.)
Agrimonia parviflora Soland. In wet soil along Lehigh river at Island Park. Aug. 25, 1902.
Sanguisorba canadensis L. In swamps and low meadows. (Porter.)
Rosa carolina L. In low grounds and swamps. (Porter.)
Rosa humilis Nash. In dry or rocky soil. (Porter.)
Rosa lucida Ehrh. On shores or in dry or sandy soil. (Porter.)
Rosa canina L. In waste places and along roadsides. (Porter.)
Rosa rubiginosa L. In waste places. (Porter.)

POMACEAE

Malus coronaria (L.) Mill. Along Saucon creek. (J. A. Ruth.)
Malus Malus (L.) Britton. Occasionally in woods and thickets.
Aronia arbutifolia (L.) Ell. In swamps and wet woods. (Porter.)
Aronia nigra (Willd.) Britton. In swamps and low woods and sometimes in drier soil. (Porter.)
Amelanchier canadensis (L.) Medic. In woods, Lehigh Mt., April 24, 1897.
Amelanchier Botryapium (L. f.) DC. In swamps and moist soil. (Porter.)
Amelanchier spicata (Lam.) Dec. In dry rocky places. (Porter.)
Crataegus punctata Jacq. In thickets. (Porter.)
Crataegus punctata canescens Britton. Near Easton. (Porter.)
Crataegus Oxyacantha L. Along roadsides and in thickets, sparingly escaped from cultivation, Bethlehem.
Crataegus coccinea L. In woods along Lehigh river near Bethlehem. May 17, 1897.
Crataegus rotundifolia (Ehrh.) Borck. In open woods. (Porter.)
Crataegus macracantha Lodd. In rocky soil and thickets, Bethlehem. May 27, 1897.
Crataegus tomentosa L. In thickets. (Porter.)
Crataegus uniflora Muench. In sandy soil. (Porter.)

DRUPACEAE

Prunus americana Marsh. In woods and thickets. (Porter.)
Prunus pumila L. On sand or gravel shores. (Porter.)
Prunus cuneata Raf. In wet soil or among rocks. (Porter.)
Prunus Cerasus L. In thickets along Lehigh river between Bethlehem and Freemansburg.
Prunus Avium L. In thickets and woodlands. (Porter.)
Prunus pennsylvanica L. f. In rocky woods and clearings. (Porter.)
Prunus Mahaleb L. Thickets and waste places. (Porter.)
Prunus virginiana L. Along bank of Lehigh river and in rocky situations.
Prunus serotina Ehrh. In fields about Bethlehem. May 23, 1899.
Amygdalus Persica L. Escaped from cultivation in waste places, Bethlehem.

CAESALPINACEAE

Cassia nictitans L. In dry soil ½ mile east of Bethlehem.
Cassia marylandica L. In moist sandy soil along Lehigh river near Bethlehem. Aug. 5, 1899.
Gleditsia triacanthos L. In dry soil, Bethlehem.

PAPILIONACEAE

Baptisia tinctoria (L.) R. Br. In woods on Lehigh Mt. July 22, 1899. Altitude 900 feet.
Crotalaria sagittalis L. In dry open places. (Porter.)

Cytisus scoparius (L.) Link. Grown on banks along P. & R. Ry. between Bethlehem and Hellertown as an experiment to prevent rain washing the soil on the tracks in the cuts. May 20, 1896.
Medicago sativa L. In fields and waste places. (Porter.)
Medicago lupulina L. In waste places, Bethlehem.
Medicago denticulata Willd. On ore dumps in Bethlehem Steel Co.'s yard. Reported in Bull. Torrey Club **19**: 9. 1892.
Melilotus alba Desv. In waste places along Lehigh canal ½ mile east of Bethlehem. July 13, 1898.
Melilotus officinalis (L.) Lam. In waste places, Bethlehem.
Melilotus indica (L.) All. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 9. 1892.
Trifolium agrarium L. In fields and waste places, Bethlehem.
Trifolium procumbens L. In fields, Bethlehem. Frequent.
Trifolium incarnatum L. In fields, waste places and ballast. (Porter.)
Trifolium arvense L. In fields near Bethlehem.
Trifolium pratense L. In fields and roadsides.
Trifolium maritimum Huds. Found at Bethlehem. (Porter.)
Trifolium hybridum L. In fields and waste places. (Porter.)
Trifolium repens L. In fields and waste places, Bethlehem. July 22, 1899.
Cracca virginiana L. In thickets between Bethlehem and Nazareth; also at Wind Gap July 2. Altitude about 978 feet. (G. W. Caffrey.)
Robinia Pseudacacia L. In woods, Bethlehem. May 18, 1899.
Stylosanthes biflora (L.) B. S. P. In dry soil. (Porter.)
Meibomia nudiflora (L.) Kuntze. In woods, Bethlehem. Aug. 25, 1900.
Meibomia grandiflora (Walt.) Kuntze. In woods on Lehigh Mt. July 22, 1899.
Meibomia Michauxii Vail. In dry woodland along Monocacy creek ½ mile north of Bethlehem. Sept. 7, 1899.
Meibomia ochroleuca (M. A. Curtis) Kuntze. In woodlands. (Porter.)
Meibomia bracteosa (Michx.) Kuntze. In thickets. (Porter.)
Meibomia paniculata (L.) Kuntze. In meadows along Monocacy creek 1 mile north of Bethlehem. Aug. 12, 1899.
Meibomia laevigata (Nutt.) Kuntze. In dry woods. (Porter.)
Meibomia viridiflora (L.) Kuntze. In dry woods. (Porter.)
Meibomia Dillenii (Darl.) Kuntze. In meadows near Bethlehem. Aug. 12, 1899.
Meibomia canadensis (L.) Kuntze. In sandy soil along Lehigh river near Bethlehem. Aug. 5, 1899.
Meibomia rigida (Ell.) Kuntze. In dry soil, Easton. Aug. 24, 1889.
Meibomia Marylandica (L.) Kuntze. In dry soil and in copses. (Porter.)
Meibomia obtusa (Muhl.) Vail. In dry soil. (Porter.)
Lespedeza repens (L.) Bart. In dry or sandy soil. (Porter.)
Lespedeza procumbens Michx. In dry soil. (Porter.)
Lespedeza Nuttallii Darl. In dry soil. (Porter.)
Lespedeza violacea (L.) Pers. In dry rocky soil in Monocacy valley 2½ miles north of Bethlehem. Sept. 3, 1899.
Lespedeza virginica (L.) Britton. In dry soil. (Porter.)
Lespedeza hirta (L.) Ell. In dry soil. (Porter.)
Vicia Cracca L. In dry soil. (Porter.)
Vicia americana Muhl. In ballast along railroad 1½ miles north of Bethlehem. June 20, 1901.
Vicia caroliniana Walt. On river banks and cliffs. (Porter.)
Vicia hirsuta (L.) Koch. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 9. 1892.
Vicia sativa L. In field at Bethlehem. Fruit mature in July.
Lathyrus venosus Muhl. At Bethlehem. (Porter.) On rocky hillsides in Allen township. June 3, 1901.
Lathyrus myrtifolius Muhl. In ballast along C. R. R. of N. J. tracks east of Bethlehem. (G. W. Caffrey.)
Falcata comosa (L.) Kuntze. In thickets at Island Park. Aug. 25, 1902.

Apios Apios (L.) MacM. In moist soil. (Porter.)
Phaseolus polystachyus (L.) B. S. P. (Porter.) In dry soil along canal near Bethlehem; along Delaware river, Easton. Aug., 1896.
Strophostyles helvola (L.) Britton. In sandy soil, Bethlehem. (Porter.)

GERANIACEAE

Geranium maculatum L. In moist woods in Saucon valley, Monocacy valley and on Lehigh Mt. Ascends about 900 feet. May 13, 1897.
Geranium carolinianum L. In dry soil along Saucon creek, 1 mile from its mouth.
Geranium pusillum L. In waste places. (Porter.)

OXALIDACEAE

Oxalis violacea L. In woods, Bethlehem. May 30, 1899.
Oxalis stricta L. In woods, fields and roadsides, Bethlehem. Common. Aug. 12, 1899.
Oxalis cymosa Small. In woods and fields. (Porter.)

LINACEAE

Linum usitatissimum L. In ballast along Lehigh Valley R. R. near Bethlehem. July 10, 1900.
Linum virginianum L. In woodland between Bethlehem and Easton. July 22, 1911.
Linum striatum Walt. In bogs and swamps. (Porter.)

ZYGOPHYLLACEAE

Tribulus terrestris L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Torrey Bulletin, Jan., 1892.

RUTACEAE

Xanthoxylum americanum Mill. In woods and thickets. (Porter.)
Ptelea trifoliata L. In woods. (Porter.)

SIMARUBACEAE

Ailanthus glandulosa Desf. Escaped along roadsides. (Porter.) Several large trees growing in cultivation in Bethlehem.

POLYGALACEAE

Polygala verticillata L. In moist soil near South Bethlehem. (J. A. Ruth.)
Polygala viridescens L. In meadows at Wind Gap.
Polygala Senega L. In woods on Lehigh Mt. Ascends to 900 feet. May 30, 1898.
Polygala paucifolia Willd. In moist rich woods. (Porter.)

EUPHORBIACEAE

Acalypha virginica L. In waste places and thickets, Bethlehem. Aug. 5, 1899.
Euphorbia maculata L. (Porter.)
Euphorbia hirsuta (Torr.) Wiegand. In sandy or gravelly soil. (Porter.)
Euphorbia nutans Lag. In fields and waste places, Bethlehem.
Euphorbia corollata L. In dry and rocky soil 1 mile east of Bethlehem. Aug. 30, 1898.
Euphorbia marginata Pursh. In waste places, Bethlehem. Occasionally.
Euphorbia Lathyris L. In waste places. (Porter.)
Euphorbia Peplus L. On ore dumps in Bethlehem Steel Co.'s yard. Reported in Bull. Torrey Club **19**: 10. 1892.

EUPHORBIA TERRACINA L. On ore dumps in Bethlehem Steel Co.'s yard. Reported in Bull. Torrey Club **19**: 10. 1892.
EUPHORBIA CYPARISSIAS L. In waste places, Bethlehem. May 1898.

CALLITRICHACEAE

CALLITRICHE PALUSTRIS L. Mostly in cold and running water. (Porter.)
CALLITRICHE HETEROPHYLLA Pursh. In ponds and slow streams. (Porter.)

LIMNANTHACEAE

FLOERKEA PROSERPINACOIDES Willd. In marshes and along rivers. (Porter.)

ANACARDIACEAE

RHUS COPALLINA L. In dry soil along Lehigh river. July 22, 1899.
RHUS HIRTA (L.) Sudw. In dry soil along Lehigh river. July 22, 1899.
RHUS GLABRA L. In dry soil near Bethlehem. July 10, 1899.
RHUS VERNIX L. In swamps. (Porter.)
RHUS RADICANS L. In thickets along streams and is only too common along the Lehigh canal; also in Monocacy valley.
COTINUS COTINOIDES (Nutt.) Britton. Escaped from cultivation, Easton. (Porter.)

ILICACEAE

ILEX VERTICILLATA (L.) A. Gray. In swamps. (Porter.)
ILICIOIDES MUCRONATA (L.) Britton. In swamps. (Porter.)

CELASTRACEAE

EUONYMUS ATROPURPUREUS Jacq. In moist soil along Saucon creek 1 mile from its mouth.
EUONYMUS EUROPAEUS L. Escaped from cultivation. (Porter.)
CELASTRUS SCANDENS L. In dry soil along Lehigh river between Bethlehem and Freemansburg, May 30, 1900; along Monocacy valley near Bethlehem. In fruit Nov. 1.

STAPHYLEACEAE

STAPHYLEA TRIFOLIA L. In thickets along Lehigh canal between Bethlehem and Freemansburg. May 12, 1902.

ACERACEAE

ACER SACCHARINUM L. Along streams. (Porter.) Extensively used as shade trees in Bethlehem.
ACER RUBRUM L. On banks of Lehigh river near South Bethlehem.
ACER SACCHARUM Marsh. In rich woods. (Porter.)
ACER NIGRUM Michx. (Porter.)
ACER SPICATUM Lam. In damp, rocky woods. (Porter.)
ACER NEGUNDO L. Along streams. (Porter.)

HIPPOCASTANACEAE

ÆSCULUS HIPPOCASTANUM L. Escaped from cultivation, Easton. (Porter.)

BALSAMINACEAE

IMPATIENS BIFLORA Walt. In wet grounds along Monocacy and Saucon creeks. Aug. 12, 1899.
IMPATIENS AUREA Muhl. In moist soil along Lehigh river and Monocacy creek. July 22, 1899.

RHAMNACEAE

Rhamnus cathartica L. In dry soil, Easton. (Porter.)
Rhamnus lanceolata Pursh. In woodland near Wind Gap.
Ceanothus americanus L. In woods between Easton and Bethlehem; also on Lehigh Mt. near Lehigh University. July 1, 1900.

VITACEAE

Vitis aestivalis Michx. In dry soil along Lehigh river.
Vitis bicolor Le Conte. In woods. (Porter.)
Vitis vulpina L. Along Lehigh river in dry soil. June 3, 1899.
Vitis cordifolia Michx. In moist thickets and along streams. (Porter.)
Parthenocissus quinquefolia (L.) Planch. In dry soil and in thickets near Bethlehem.

TILIACEAE

Tilia americana L. Along bank of Lehigh River near Bethlehem.

MALVACEAE

Althaea rosea Cav. Has escaped from gardens. (Porter.)
Malva sylvestris L. In waste places and along roadsides. (Porter.)
Malva rotundifolia L. In waste places and about dwellings, Bethlehem.
Malva moschata L. In waste places. (Porter.)
Malva Alcea L. A few specimens found in a meadow along Saucon creek about 2 miles from its mouth. Sept. 4, 1900.
Abutilon Abutilon (L.) Rusby. In waste places, Bethlehem.
Hibiscus Trionum L. In waste places. (Porter.)
Hibiscus Syriacus L. Escaped from cultivation, Bethlehem.

HYPERICACEAE

Hypericum Ascyron L. Along bank of Lehigh river, Bethlehem. July 15, 1899.
Hypericum ellipticum Hook. In sandy soil on Calypso Island. Aug., 1899.
Hypericum perforatum L. In fields, Bethlehem.
Hypericum maculatum Walt. In woods near South Bethlehem. (J. A. Ruth.)
Hypericum mutilum L. In moist grounds along mountain stream, Lehigh Mt.
Hypericum canadense L. In wet, sandy soil. (Porter.)
Sarothra gentianoides L. In sandy soil. (Porter.)
Triadenum virginicum (L.) Raf. In swamps. (Porter.)

CISTACEAE

Helianthemum canadense (L.) Michx. In dry soil on Lehigh Mt. (J. A. Ruth.)
Lechea racemulosa Michx. In dry sandy or rocky soil. (Porter.)
Lechea villosa Ell. In dry soil. (Porter.)
Lechea intermedia Leggett. In dry open places. (Porter.)

(*To be continued*)

NEWS ITEMS

The statement on page 120 of May Torreya that the Flora Brasiliensis was to be found in America only at the University of Illinois, Harvard, Columbia, and the Missouri Botanical Garden was incomplete. Copies of this work have turned up at

Detroit, in the library of Parke, Davis and Company, at the Academy of Natural Sciences at Philadelphia, and at the Ohio State University.

Dr. Edgar W. Olive, professor of botany in the State College of South Dakota and state botanist, has been appointed curator at the Brooklyn Botanic Garden, to have charge of the department of public instruction and also of the work in plant pathology. The appointment takes effect on September 1, next.

Dr. C. J. Chamberlin of the University of Chicago has just returned from Australia and South Africa where he has been making a field study of the oriental cycads, and collecting material for a detailed morphological investigation.

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TORREYA

ROADSIDE PLANTS OF A HIGH MOUNTAIN PARK IN COLORADO

By Mary Esther Elder

The following is a report on a collection of roadside plants made by Professor Francis Ramaley in the summer of 1911 at the University of Colorado Mountain Laboratory at Tolland, Colorado. The laboratory is situated in Boulder Park, Gilpin Co., about forty-seven miles from Denver and eighteen miles from Boulder. The altitude of Tolland is 8,889 feet. The list is of interest as showing the roadside weeds of a rather high mountain station.*

Boulder Park is on the old Rollins Pass Road which goes from the plains across the range into Middle Park. This road has been used for the last forty or fifty years, by cattlemen, to drive cattle over into Middle Park for pasturing. Nederland and Central City, both old mining camps, eight and twelve miles away, respectively, may be reached by road from Boulder Park. Rollinsville, formerly a placer mining camp is five miles distant on the direct wagon road from the plains region, through Boulder Park, to the Continental Divide. The Moffat Railroad was built through the Park about eight years ago, thus making another means for the introduction of new plants. The soil along the roadsides is, for the most part, very dry and either sandy or rocky. Nearly all of the species here recorded occur in this dry soil. The following, however, are found in moister

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* There are only two articles which the writer has found giving information regarding the subject of roadside weeds in Colorado: European Plants Growing without Cultivation in Colorado, by Francis Ramaley, printed in Annales du Jardin Botanique de Buitenzorg, 1909, and Remarks on the Distribution of Plants in Colorado East of the Divide, by Francis Ramaley, reprinted from Postelsia, 1901.

places: *Juncus balticus montanus*, *Rumex acetosella*, *Rumex occidentalis*, *Rumex crispus*, *Rumex salicifolius*, *Anchusa officinalis*, *Prunella vulgaris*, *Iva xanthifolia* and *Festuca rubra*.

The altitudinal limits of the plants listed are given by Rydberg* as 4,000 to 13,000 feet. Some plants are found above their hitherto reported range as: *Festuca rubra*, *Bromus tectorum*, *Elymus canadensis*, *Rumex crispus*, *Chenopodium oblongifolium*, *Melilotus officinalis*, *Iva xanthifolia*, these all being reported by Rydberg as reaching altitudes of 7,000 feet or less.

Sixty-four plants are listed below; of these sixteen belong to Poaceae, six to Polygonaceae and thirteen to Compositae. Forty-two plants of the list are native to North America. Some, however, have been introduced into Boulder Park from lower altitudes and probably do not produce seeds there. Twenty-one are introduced from Europe, Asia or Tropical America. *Plantago major* (common plantain) is cosmopolitan but, of course, introduced at this altitude from lower stations.

POACEAE

Phleum pratense L. Common Timothy.
Europe.

Trisetum majus (Vasey) Rydb. Larger False Oats.
Native.

Koeleria cristata (L.) Pers. Prairie-grass.
Native.

Dactylis glomerata L. Common Orchard Grass.
Europe.

Poa pratensis L. Kentucky Blue-grass.
Europe; Asia; North America.

Poa compressa L. English Blue-grass.
Europe and Asia. Introduced to North America.

Poa serotina Ehr.
Native.

Festuca rubra L. Red Fescue.
Europe, Asia.

Bromus pumpellianus Scribn. Pumpelly's Brome.
Native.

* Rydberg, Flora of Colorado, 1906.

Bromus tectorum L. Thatch Cheat.
Europe.

Agropyron violaceum (Hornem.) Vasey. Violet Wheat Grass.
Native.

Agropyron tenerum Vasey. Slender Wheat Grass.
Native.

Agropyron occidentale Scribn. Western Wheat Grass.
Native. (Introduced from lower altitudes.)

Hordeum jubatum L. Squirrel-tail Grass.
Native. (Introduced from lower altitudes.)

Hordeum sativum hexastichon (L.) Hack. Six-rowed Barley.
Old World, thence to the New.

Elymus canadensis Linn. Canadian Wild Rye.
Native. (Introduced from lower altitudes.)

JUNCACEAE

Juncus balticus montanus Engelm. Mountain Baltic Rush.
Native.

POLYGONACEAE

Rumex acetosella L. Sheep Sorrel.
Europe: Asia, thence to North America.

Rumex occidentalis Wats. Dense-flowered Dock.
Native.

Rumex crispus L. Curly Dock.
Europe and Asia, thence to North America.

Rumex salicifolius Weinm. Willow-leaved Dock.
Native.

Polygonum aviculare L. Doorweed.
Asia: Europe: North America.

Tiniaria convolvulus (L.) Webb. & Moq. False Buckwheat.
Europe, Asia, thence to North America.

CHENOPODIACEAE

Chenopodium oblongifolium (S. Wats.) Rydb. Oblong Leaved Goosefoot.
Native.

Chenopodium album L. Common Pigweed.
Europe, Asia.

Monolepis nuttalliana (R. & S.) Engelm. Nuttall's Monolepis.
Native.

PAPAVERACEAE

Capnoides aureum (Willd.) Kuntze. Golden Corydalis.
Native.

BRASSIACEAE

Lepidium ramosissimum A. Nels. Pepper Grass.
Native.

Lepidium densiflorum Schrad. Apetalous Pepper Grass.
Europe.

Bursa Bursa-pastoris (L.) Britton. Common Shepherd's Purse.
Europe, thence now cosmopolitan.

Roripa sinuata (Nutt.) A. S. Hitch. Spreading Yellow Cress.
Native. (Probably introduced from lower altitudes.)

Brassica arvensis (L.) B.S.P. Wild Mustard.
Europe.

CAPPARIDACEAE

Peritoma serrulatum (Pursh) DC. Rocky Mountain Bee Plant.
Native. (Introduced from lower altitudes. Probably does not mature seeds.)

ROSACEAE

Rubus strigosus Michx. Raspberry.
Native.

Potentilla monspeliensis L. Rough Cinquefoil.
Native.

Potentilla pennsylvanica strigosa Pursh. Villous Pennsylvania Cinquefoil. Native.

Fragaria glauca (S. Wats.) Rydb. Glaucous Strawberry.
Native.

FABACEAE

Trifolium pratense L. Red Clover.
Europe and Asia, thence cultivated and naturalized in all temperate lands.

Trifolium repens L. White Clover.
Europe.

Melilotus officinalis (L.) Lam. Yellow Melilot.
Europe and Asia, thence to North America. (Probably does not mature seeds at this altitude.)

Aragallus deflexus (Pall.) Heller. Deflexed Loco-weed.
Native.

EPILOBIACEAE

Chamaenerion angustifolium (L.) Scop. Narrow-leaved Fireweed.
Native.

Gayophytum ramossisimum T. & G. Gayophyte.
Native.

POLEMONIACEAE

Collomia linearis Nutt. Narrow-leaved Collomia.
Native.

HYDROPHYLLACEAE

Phacelia leucophylla Torr. White-leaved Phacelia.
Native.

Phacelia sericea Hook. Hairy Phacelia.
Native.

BORAGINACEAE

Lappula occidentalis (S. Wats.) Greene. Western Stickweed.
Native.

Anchusa officinalis L.
Europe.

LAMIACEAE

Dracocephalum parviflorum Nutt. Small-flowered Dragon's Head.
Native.

Prunella vulgaris L. Common Self-heal.
Europe and Asia, thence to North America, where northward it is possibly native.

PLANTAGINACEAE

Plantago major L. Common Plantain.

Cosmopolitan. (Introduced at this altitude from lower stations.)

AMBROSIACEAE

Iva xanthifolia Nutt. Burweed Marsh-elder.

Native. (Probably does not produce seeds at this altitude.)

COMPOSITAE

Grindelia erecta A. Nels. Erect Gum Plant.

Native.

Chrysopsis villosa (Pursh) Nutt. Villous Golden Aster.

Native.

Solidago concinna Nels. Golden Rod.

Native.

Aster adscendens Lindl. Ascending Aster.

Native.

Machaeranthera viscosa (Nutt.) Greene. Sticky Aster.

Native.

Achillea lanulosa Nutt. Woolly Yarrow.

Native.

Artemisia Forwoodii S. Wats. Forwood's Sage. (Segregate of *Artemisia canadensis*.)

Native.

Artemisia frigida Willd. Barrens Sage.

Native.

Artemisia rhizomata A. Nels. Cudweed Sage.

Native.

Artemisia gnaphalioides Nutt. Cudweed Sage.

Native.

Senecio rosulatus Rydb. Tufted Groundsel.

Native.

Senecio ambrosioides Rydb. Ragweedlike Groundsel.

Native.

Taraxacum Taraxacum (L.) Karst. Common Dandelion.

Europe, thence to North America.

CHLORANTHY AND VIVIPARY IN THE STAMINATE INFLORESCENCE OF EUCHLAENA MEXICANA

By J. Arthur Harris

In certain grasses, the constituent members of the spikelet are sometimes found more or less completely foliaceous,* the ovary

Fig. 1. Excessive glume development of *Euchlaena mexicana*.

and stamens sterile or abortive. Becoming detached, these sterile spikelets may serve for vegetative propagation. Indeed,

* See, for instance, Masters, Vegetable Teratology, pp. 168–170. The Graminaceae in Penzig's Pflanzen Teratologie may be gone through for references to the literature of individual species.

in certain species this method of reproduction is practically the normal one.* Such forms have sometimes been designated as viviparous, and the term is extended beyond the cases in which there is an actual vegetative reproduction, to those in which there is merely a teratological foliation of the spikelet.

Chloranthy is a term applied to the transformation of the parts of the flower into foliar organs, and this term might perhaps more properly be applied to many cases which have been described as vivipary, not only in grasses but among other monocotyledons.

The purpose of this note is, however, not to discuss the literature of this phenomenon, but merely to call attention to a rather remarkable case in *Euchlaena mexicana*, supposedly the ancestor of Indian corn.

One of the terminal staminate inflorescences of a small plot of plants grown in the Missouri Botanical Garden† in the summer of 1903 was noticed by my friend Dr. G. G. Hedgecock to be highly abnormal and he kindly placed the accompanying photograph in my hands. It shows a condition of excessive development of the glumes.

To determine whether these teratological spikelets were capable of continued development, a number of them were potted up in

* See Goebel, Organographie der Pflanzen, pp. 153, 159.

† The seeds were received as "Mais de Coyote" from a gentleman in San Luis Potosi, who stated that it is generally thought that under cultivation the form would change into ordinary maize. As examined the tenth of September most of the stalks were in a vigorous green condition, the pistillate inflorescences not yet mature. All who have grown the form (Watson, Baily, Harshberger) have noted the lateness of maturing. The largest of the culms attained a height of ten to thirteen feet. The suckering was not as conspicuous as described by Watson, while the habit of producing elongated axillary branches was retained, but owing to the immature condition of the plants much cannot be stated concerning the behavior of the axillary (pistillate) inflorescences. Watson does not mention the adventitious roots, but Harshberger notes the production of strong aerial roots at nearly all nodes below the ears. The same is true in my material, as many as the lower thirteen nodes being well supplied with these organs.

Whatever their ancestry—whether pure *E. mexicana* or with some admixture of *Zea Mays*—the Missouri Botanical Garden plants were very close to the typical *E. mexicana*.

The immaturity of the pistillate inflorescence at frost precludes the settling of some of the minor details.

sand, and later transferred to soil. Good roots were secured, and a considerable expansion of the leaves and elongation of the internodes, but I am inclined to doubt whether any new leaves were laid down. One of these rooted spikelets produced three stigmas, "silks," an additional abnormality in the staminate inflorescence.

Such chloranthy or vivipary has sometimes been observed in *Zea Mays*. Perhaps some one finding it again may be so fortunate as to get good vegetative propagations. Possibly the technique adopted in my attempts was not adequate, but a wide series of experiments could not be made.

THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Wilbur L. King

(*Continued from July* Torreya)

VIOLACEAE

Viola palmata L. In thickets in Monocacy valley 1 mile north of Bethlehem, Apr. 22, 1897.; on dry hillsides of Lehigh Mt. near South Bethlehem, May 30. Altitude 850 feet.

Viola papilionacea Pursh. In woodlands. (Porter.)

Viola obliqua Hill. In woodland along Monocacy Creek 1 mile north of Bethlehem. April 22, 1897.

Viola domestica Bickn. In cultivated soil and about dwellings. Bethlehem.

Viola cucullata Ait. In bogs and meadows. (Porter.)

Viola villosa Walt. In woods near South Bethlehem. May 30.

Viola sororia Willd. In woodland along Monocacy valley near Bethlehem.

Viola sagittata Ait. In wet meadows and marshes. (Porter.)

Viola fimbriatula J. E. Smith. On hillsides of Lehigh Mt. near Lehigh University. Altitude 850 feet.

Viola pedata L. At Bougher Hill, Williams township (J. A. Ruth). In copse on Lehigh Mt. May 9, 1896. Altitude 900 feet.

Viola odorata L. In thickets along Monocacy creek 1 mile north of Bethlehem.

Viola blanda Willd. In damp woods on Lehigh Mt. May 13, 1899.

Viola lanceolata L. In wet meadows along streams. (Porter.)

Viola pubescens Ait. In woods on Lehigh Mt. April 27, 1896.

Viola scabriuscula (T. & G.) Schwein. In moist woods along Monocacy creek 1½ miles north of Bethlehem.

Viola striata Ait. In moist thickets along Lehigh canal 1 mile east of Bethlehem. May 9, 1896.

Viola rostrata Pursh. In rocky woods. (Porter.)

Viola tricolor L. In waste places, sparingly escaped. (Porter.)

Viola Rafinesquii Greene. On hillsides. (Porter.)

Cubelium concolor (Forst.) Raf. In moist woods. (Porter.)

THYMELEACEAE

Dirca palustris L. In woods and thickets. (Porter.)

LYTHRACEAE

Decodon verticillatus (L.) Ell. In swamps. (Porter.)
Lythrum Salicaria L. In moist places along the Delaware River at Portland, July 4, 1912.
Parsonsia petiolata (L.) Rusby. In sandy soil, and in fields 1 mile east of Bethlehem and in meadow 1 mile north of Bethlehem.

ONAGRACEAE

Isnardia palustris L. In muddy ditches and swamps. (Porter.)
Ludwigia alternifolia L. In moist sandy soil along Lehigh river near Bethlehem. Aug. 5, 1899.
Chamaenerion angustifolium (L.) Scop. In dry soil. (Porter.)
Epilobium coloratum Muhl. In meadow land, Bethlehem. Aug. 12, 1899.
Onagra biennis (L.) Scop. In dry soil 1 mile east of Bethlehem. July 10, 1899.
Kneiffia pumila (L.) Spach. In clearing on Lehigh Mt. Altitude 900 feet.
Kneiffia fruticosa (L.) Raimann. In dry soil. (Porter.)
Kneiffia fruticosa pilosella (Raf.) Britton. On banks. (Porter.)
Gaura biennis L. In dry soil at Island Park. Aug. 25, 1902.
Circaea Lutetiana L. In moist woods on Lehigh Mt. near Lehigh University. Altitude 850 feet. July 1, 1899.
Circaea alpina L. Associated with the preceding species. June 1, 1899.

HALORAGIDACEAE

Proserpinaca palustris L. In swamps. (Porter.)

ARALIACEAE

Aralia racemosa L. In rich woods. (Porter.)
Aralia nudicaulis L. In woods on Lehigh Mt. May 22, 1898.
Panax quinquefolium L. In rich woods. (Porter.)
Panax trifolium L. In damp woodland at Nazareth. July 7, 1901.

UMBELLIFERAE

Daucus Carota L. In fields and waste places; entirely too frequent.
Angelica atropurpurea L. In swamps and moist grounds. (Porter.)
Angelica villosa (Walt.) B. S. P. In dry soil. (Porter.)
Oxypolis rigidus (L.) Britton. In swamps. (Porter.)
Heracleum lanatum Michx. In moist grounds. (Porter.)
Pastinaca sativa L. In waste places and along roadsides, Bethlehem, Easton and Portland. Common.
Thaspium trifoliatum (L.) Britton. In woods. (Porter.)
Thaspium trifoliatum aureum (Nutt.) Britton. In woods and shaded situations east of Bethlehem.
Thaspium barbinode (Michx.) Nutt. Along streams. (Porter.)
Sanicula marylandica L. In woods near South Bethlehem.
Sanicula gregaria Bicknell. In woods and thickets. (Porter.)
Sanicula canadensis L. In woodland. (Porter.)
Foeniculum Foeniculum (L.) Karst. In waste places. (Porter.)
Taenida integerrima (L.) Drude. In rocky or sandy soil. (Porter.)
Pimpinella Saxifraga L. In waste places, Easton. (Porter.)
Anthriscus Cerefolium (L.) Hoffm. Naturalized from Europe. (Porter.)
Chaerophyllum procumbens (L.) Crantz. In moist shady soil along Lehigh canal 1 mile east of Bethlehem. May 12, 1900.
Washingtonia Claytoni (Michx.) Britton. In woods and clearings. (Porter.)

WASHINGTONIA LONGISTYLIS (Torr.) Britton. In shaded, sandy soil, Calypso Island, Bethlehem.
CONIUM MACULATUM L. In waste places. (Porter.)
SIUM CIRCUTAEFOLIUM Gmel. In swamps. (Porter.)
ZIZIA AUREA (L.) Koch. In moist soil along towpath between Bethlehem and Freemansburg. June 3, 1899.
CICUTA MACULATA L. Along bank of Lehigh river, Bethlehem; also along the Delaware River, Portland.
CICUTA BULBIFERA L. In wet soil along Lehigh canal near Bethlehem. Sept. 16, 1899.
DERINGA CANADENSIS (L.) Kuntze. In shaded sandy soil on Calypso Island. Aug. 7, 1899; along Delaware River, Portland.
AEGOPODIUM PODAGRARIA L. In waste places, Bethlehem. (Porter.)
HYDROCOTYLE AMERICANA L. In wet places. (Porter.)
CORIANDRUM SATIVUM L. Adventive. (Porter.)

CORNACEAE

CORNUS FLORIDA L. In rocky woods along Monocacy valley 1 mile north of Bethlehem. May 17, 1897.
CORNUS AMONUM Mill. In wet soil. (Porter.)
CORNUS STOLONIFERA Michx. In moist soil near Island Park. Aug. 25, 1901.
CORNUS CANDIDISSIMA Marsh. In rich soil along Monocacy creek. June 20, 1901.
CORNUS ALTERNIFOLIA L. f. In woods near Bethlehem.
NYSSA SYLVATICA Marsh. In rich soil, Bethlehem.

CLETHRACEAE

CLETHRA ALNIFOLIA L. In wet soil. (Porter.)

PYROLACEAE

PYROLA ROTUNDIFOLIA L. In dry woods. (Porter.)
PYROLA ELLIPTICA Nutt. In woods on Lehigh Mt. Ascends 850 feet. July 1, 1899.
CHIMAPHILA MACULATA (L.) Pursh. In woods on Lehigh Mt.
CHIMAPHILA UMBELLATA (L.) Nutt. In rocky woodland on Lehigh Mt. near South Bethlehem. Ascends to 850 feet; also at Nazareth.

MONOTROPACEAE

MONOTROPA UNIFLORA L. In woods on Lehigh Mt. July, 1896.
HYPOPITYS HYPOPITYS (L.) Small. In dry woods. (Porter.)

ERICACEAE

AZALEA NUDIFLORA L. In copses on Lehigh Mt. May 22, 1898.
AZALEA NUDIFLORA GLANDIFERA Porter. (Porter.)
AZALEA VISCOSA L. In swamps. (Porter.)
RHODODENDRON MAXIMUM L. In woods on Lehigh Mt.
KALMIA ANGUSTIFOLIA L. In moist soil. (Porter.)
KALMIA LATIFOLIA L. On rocky hillsides, Lehigh Mt. near Lehigh University. Ascends 800 feet. May 30, 1900.
XOLISMA LIGUSTRINA (L.) Britton. In swamps and wet soil. (Porter.)
EPIGAEA REPENS L. In woods between Bethlehem and Nazareth. April 25, 1896.
GAULTHERIA PROCUMBENS L. In woodland near Wind Gap. July 4, 1901.

VACCINIACEAE

GAYLUSSACIA FRONDOSA (L.) T. & G. In moist woods. (Porter.)
GAYLUSSACIA RESINOSA (Ait.) T. & G. In woods near South Bethlehem. (J. A. Ruth.)

Vaccinium corymbosum L. In swamps, thickets and low woods. (Porter.) In woods near South Bethlehem. (J. A. Ruth.)
Vaccinium canadense Richards. In moist places. (Porter.)
Vaccinium pennsylvanicum Lam. In dry, rocky or sandy soil. (Porter.)
Vaccinium vacillans Kalm. In dry soil. (Porter.)
Vaccinium stamineum L. In dry woods and thickets. (Porter.)
Oxycoccus macrocarpus (Ait.) Pers. In bogs. (Porter.)

PRIMULACEAE

Lysimachia punctata L. In waste places. (Porter.)
Lysimachia quadrifolia L. In thickets on Lehigh Mt. Altitude 900 feet. June 12, 1896.
Lysimachia terrestris (L.) B. S. P. In wet grounds along canal, Bethlehem. July 20, 1899.
Lysimachia Nummularia L. In damp or grassy situations, Bethlehem.
Steironema ciliatum (L.) Raf. In moist sandy soil along Lehigh river east of Bethlehem. July 15, 1899, also at Portland.
Trientalis americana Pursh. In damp woods and thickets. (Porter.)
Anagallis arvensis L. In meadows along Monocacy creek 1 mile north of Bethlehem. July, 1896.

EBENACEAE

Diospyros virginiana L. In fields and woods. (Porter.)

OLEACEAE

Syringa vulgaris L. Escaped from cultivation. (Porter.)
Fraxinus americana L. In moist soil along Monocacy creek near Bethlehem. Sept. 3, 1899, in fruit.
Fraxinus pennsylvanica Marsh. In moist soil. (Porter.)
Fraxinus nigra Marsh. In swamps and wet grounds. (Porter.)
Ligustrum vulgare L. Escaped from cultivation. (Porter.)

GENTIANACEAE

Erythraea Centaurium (L.) Pers. In waste places, Nazareth. (Porter.)
Sabbatia angularis (L.) Pursh. In rich soil. (Porter.)
Gentiana crinita Froel. In moist woods and meadows in Monocacy valley, Sept. 28, 1897. (G. W. Caffrey.)
Gentiana quinquefolia L. In dry rocky soil along L. V. R. R. near South Bethlehem. Sept. 28, 1896.
Gentiana Andrewsii Griseb. In moist soil. (Porter.)
Obolaria virginica L. In woods between Bethlehem and Nazareth; also on Lehigh Mt. May, 1899.
Bartonia iodandra Robinson. Specimens doubtfully referred here have been found in Northampton county. (Porter.)

APOCYNACEAE

Apocynum androsaemifolium L. In fields and thickets, Bethlehem. July 1' 1900.
Apocynum cannabinum L. In fields and thickets. (Porter.)
Apocynum album Greene. On river shores. (Porter.)

ASCLEPIADACEAE

Asclepias tuberosa L. In dry stony thickets, 1 mile east of Bethlehem.
Asclepias decumbens L. In dry fields. (Porter.)
Asclepias incarnata L. In meadows along Monocacy creek and along bank of Lehigh river near Bethlehem. July 15, 1899.
Asclepias pulchra Ehrh. In moist fields and swamps. (Porter.)

Asclepias variegata L. In dry woods or thickets. (Porter.)
Asclepias quadrifolia Jacq. In copse on Lehigh Mt. May 30, 1896. Altitude 900 feet.
Asclepias Syriaca L. Common in uncultivated fields and along roadsides, Bethlehem.
Asclepias verticillata L. Dry hills and fields. (Porter.)
Acerates viridiflora (Raf.) Eaton. In dry, sandy or rocky soil. (Porter.)

CONVOLVULACEAE

Quamoclit coccinea (L.) Moench. Along river banks in waste places. (Porter.)
Ipomoea pandurata (L.) Meyer. In dry soil. Bethlehem.
Ipomoea purpurea (L.) Roth. In waste places, Bethlehem.
Ipomoea hederacea Jacq. In waste places, Bethlehem.
Convolvulus sepium L. In waste places and hedges, Bethlehem. Sept. 7, 1899, also at Portland.
Convolvulus Japonicus Thunb. Escaped from cultivation. (Porter.)
Convolvulus spithamaeus L. In clearing on Lehigh Mt. June 1, 1903, ascending 900 feet. (G. W. Caffrey.)
Convolvulus arvensis L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.

CUSCUTACEAE

Cuscuta Epithymum Murr. Usually on clover. (Porter.)
Cuscuta Cephalanthi Engelm. On shrubs and tall herbs. (Porter.)
Cuscuta Gronovii Willd. Common on herbs in moist places along Lehigh canal, Bethlehem.

HYDROPHYLLACEAE

Hydrophyllum virginicum L. In thickets along Saucon creek 2 miles from its mouth.

BORAGINACEAE

Heliotropium europaeum L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
Cynoglossum officinale L. On dry hillsides, Lehigh Mt. Altitude 850 feet. May 30, 1896.
Lappula virginiana (L.) Greene. In dry soil, Bethlehem. July 15, 1899.
Mertensia virginica (L.) DC. In low meadows and along streams. (Porter.)
Myosotis laxa Lehm. Along mountain streams, Lehigh Mt. near South Bethlehem. May 30, 1898.
Myosotis arvensis (L.) Lam. In fields. (Porter.)
Myosotis virginica (L.) B. S. P. On dry hills and banks. (Porter.)
Lithospermum arvense L. On dry hillsides, Lehigh Mt. May 12, 1900.
Lithospermum canescens (Michx.) Lehm. In dry soil. (Porter.)
Symphytum officinale L. In waste places. (Porter.)
Echium vulgare L. In ballast on C. R. R. of N. J. tracks and in dry soil along Lehigh canal, Bethlehem.

VERBENACEAE

Verbena urticifolia L. In waste places, Bethlehem.
Verbena hastata L. In moist grounds along Monocacy creek, Bethlehem.
Verbena angustifolia Michx. In dry fields. (Porter.)

LABIATAE

Teucrium canadense L. In moist soil, Bethlehem. July 22, 1899.
Isanthus brachiatus (L.) B. S. P. In ballast along C. R. R. track 1 mile east of Bethlehem. Sept. 4, 1899.

TRICHOSTEMA DICHOTOMUM L. In ballast along C. R. R. of N. J. tracks near Glendon. Aug. 25, 1902.
SCUTELLARIA LATERIFLORA L. In meadows in Monocacy valley; along mountain stream on Lehigh Mt. Aug. 12, 1899, altitude 850 feet; along bank of Lehigh river at Island Park.
SCUTELLARIA PILOSA Michx. In woods on Lehigh Mt. July 1, 1899.
SCUTELLARIA PARVULA Michx. In moist sandy soil. (Porter.)
SCUTELLARIA GALERICULATA L. In swamps and along streams. (Porter.)
MARRUBIUM VULGARE L. In waste places. (Porter.)
AGASTACHE NEPETOIDES L. In thickets along Monocacy creek. Aug. 12.
AGASTACHE SCROPULARIAEFOLIA (Willd.) Kuntze. In woods and thickets. (Porter.)
NEPETA CATARIA L. In waste places, Bethlehem.
GLECOMA HEDERACEA L. In waste places, Bethlehem. May 8, 1899.
PRUNELLA VULGARIS L. In fields, waste places and along roadsides, Bethlehem.
LEONURUS CARDIACA L. In waste places along Delaware river several miles below Easton. June 11.
LAMIUM AMPLEXICAULE L. In fields and thickets near Bethlehem. May 7, 1899.
LAMIUM MACULATUM L. Along roadsides. Escaped from cultivation. Bethlehem. June 3, 1901.
STACHYS PALUSTRIS L. In moist soil. (Porter.)
SALVIA LYRATA L. In dry, mostly sandy soil and thickets. (Porter.)
MONARDA DIDYMA L. In moist soil, along Delaware river above Easton. (Porter.)
MONARDA CLINOPODIA L. In woods and thickets. (Porter.)
MONARDA FISTULOSA L. On dry hills and in thickets. (Porter.)
MONARDA MEDIA Willd. In moist thickets above Easton. (Porter.)
MONARDA MOLLIS L. In dry soil. (Porter.)
BLEPHILIA CILIATA (L.) Raf. In dry woods and thickets. (Porter.)
HEDEOMA PULEGIOIDES (L.) Pers. In dry soil on Lehigh Mt. near Lehigh University, altitude 800 feet; also along Monocacy creek, July 20.
MELISSA OFFICINALIS L. In waste places, thickets and woods. (Porter.)
CLINOPODIUM VULGARE L. In fields 1 mile north of Bethlehem. July 10, 1899.
ORIGANUM VULGARE L. In fields and waste places. (Porter.)
KOELLIA FLEXUOSA (Walt.) MacM. In fields and thickets. (Porter.)
KOELLIA VIRGINIANA (L.) MacM. In fields along Monocacy creek near Bethlehem. Aug. 12.
KOELLIA VERTICILLATA (Michx.) Kuntze. In dry fields and thickets. (Porter.)
KOELLIA CLINOPODIOIDES (T. & G.) Kuntze. In dry soil. (Porter.)
KOELLIA INCANA (L.) Kuntze. Dry hillsides and thickets. (Porter.)
KOELLIA MUTICA (Michx.) Britton. In sandy soil at Island Park. Aug. 25, 1902.
CUNILA ORIGANOIDES (L.) Britton. In dry woods, Lehigh Mt. (J. A. Ruth.)
LYCOPUS VIRGINICUS L. In moist soil on bank of Lehigh river at Bethlehem.
LYCOPUS COMMUNIS Bicknell. In moist soil. (Porter.)
LYCOPUS AMERICANUS Muhl. In moist soil along Lehigh river, Bethlehem. July 15, 1899.
MENTHA SPICATA L. In wet soil and in waste places, Bethlehem. July 22, 1899.
MENTHA PIPERITA L. In meadows along Saucon creek and along Monocacy creek.
MENTHA LONGIFOLIA (L.) Huds. In waste places. (Porter.)
MENTHA ROTUNDIFOLIA (L.) Huds. In waste places, Bethlehem.
MENTHA CRISPA L. In swamps and roadside ditches. (Porter.)
MENTHA ARVENSES L. In dry waste places. (Porter.)
MENTHA GENTILIS L. In waste places and along streams. (Porter.)
MENTHA SATIVA L. In waste places, Bethlehem. July 22, 1899; also at Easton.

Mentha canadensis L. In moist sandy soil along Lehigh river, Bethlehem. Aug. 5, 1899. Along Delaware river above Easton.
Collinsonia canadensis L. In woods on Lehigh Mt. July 22, 1899.
Perilla frutescens (L.) Britton. In waste places as an escape at Easton. (Porter.)

SOLANACEAE

Physalodes physalodes (L.) Britton. In waste places, escaped. (Porter.)
Physalis Philadelphica Lam. In waste places, Bethlehem.
Physalis virginiana Mill. In rich soil and open places. (Porter.)
Physalis virginiana intermedia Rydberg. (Porter.)
Physalis heterophylla Nees. In rich soil, Bethlehem.
Solanum nigrum L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
Solanum carolinense L. In sandy soil along Lehigh river at Bethlehem. Aug. 5, 1899.
Solanum Dulcamara L. In moist soil along Monocacy creek, Bethlehem. July 6, 1898, also at Portland.
Lycopersicon Lycopersicon (L.) Karst. In waste places, escaped, Bethlehem.
Datura Stramonium L. In fields and waste places, Bethlehem. Sept. 28, 1896.
Datura Tatula L. In fields and waste places, Bethlehem.
Nicotiana rustica L. In fields and waste places. (Porter.)
Nicotiana longiflora Cav. Escaped from gardens, Easton. (Britton & Brown Vol. 3, p. 141.)
Petunia axillaris (Lam.) B. S. P. In waste places. (Porter.)
Petunia violacea Lindl. In waste places, escaped. (Porter.)

(*To be concluded.*)

SHORTER NOTES

On the Identity of *Dolichos unguiculatus* Linnaeus.—In the first edition of the Species Plantarum Linnaeus described a plant from Barbados as *Dolichos unguiculatus*, the binomial being based on an earlier description in the Hortus Upsalensis, 1748, p. 214. The original description in the latter work is as follows:

"Dolichos leguminibus subcylindraceis capitatis: acumine recurvo concavo.
Phaseolus barbadensis, siliqua tenui recta, semine ex purpuro nigricante.
Habitat in *Barbados.*
Hospitatur in *Caldario,* annua.
Obs. *Flos purpureus est.*"

It appears from this description that the plant was grown in the hothouse at Upsala, the seed having been obtained from Barbados.

In 1770, Jacquin (Hort. Vind., 1, pl. 23) published a colored

plate of what he regarded to be Linnaeus's *Dolichos unguiculatus*. It is not apparent how Jacquin was misled, but the plant he figured is the catjang (*Vigna catjang*), very often regarded as a variety of the cowpea (*Vigna sinensis*).

In 1842, Walpers, Rep. 1: 779, transferred Linnaeus's species to *Vigna* as *Vigna unguiculata*, with little doubt basing his idea of its identity on the colored plate of Jacquin, though in the meantime the name of Linnaeus had been already taken up by some authors as the oldest name of the cowpea, for example by Guillemin, Perrotet and Richard, Flora Senegamb. Tent. 1830–33.

In many floras *Vigna unguiculata* is quoted as a synonym of *Vigna sinensis* (in a broad sense), and I have been able to find no single instance where it has been otherwise employed.

It was a matter of some surprise, therefore, upon examining Linnaeus's original specimen preserved in the Herbarium of the Linnaean Society, London, to find that it is not the cowpea at all, nor indeed a very close relative. It is in fact the plant recently described by Urban as *Phaseolus antillanus* (Symb. Ant. 4: 309). As the species seems properly referable to *Phaseolus* it will have to bear the name **Phaseolus unguiculatus** (L.). The following collections represent *Phaseolus unguiculatus:* Cuba, Wright, No. 1594, "in Cuba orientale," Sept. 1859–Jan. 1860; Porto Rico, P. Sintenis, No. 2938, Dec. 2, 1885; St. Vincent, H. H. & G. W. Smith, No. 1181, March, 1890.

C. V. Piper

CURRENT LITERATURE

A Supposed Fossil Fern Becomes a Pine Tree.—In a recent number of the *Annals of Botany* (**25**: 903–907. O. 1911) Dr. Marie C. Stopes has printed an interesting paper under the title: "On the True Nature of the Cretaceous Plant *Ophioglossum granulatum* Heer." In this paper Doctor Stopes has conclusively shown that the American specimens of this species, which was named and described originally by Heer from the Patoot beds of Greenland, and later identified by Newberry in the

stratigraphically similar Amboy Clays of New Jersey, is not a fern at all but represents the staminate strobile (aments) of *Pinus*. By carefully dissecting some of the so-called granules of the fruit-spike Doctor Stopes was able to demonstrate the presence of numerous winged pollen grains characteristic of certain of the Pinaceae, especially *Pinus*, and these in conjunction with the association on the specimens of what are with little doubt the leaves of *Pinus*, make its reference to this genus reasonably certain.

Thus far no exception can be taken to the paper, but in the discussion which attends the discovery of the pollen grains, Doctor Stopes, by an ingenious arrangement of quotations, has made it appear that Doctor Newberry was inclined to regard the plant in question as actually referable to *Ophioglossum*. In order, therefore, that Doctor Newberry's views may be made perfectly clear, the following quotation (Fl. Amboy Clays, Monog. U. S. Geol. Surv., **26**: 43. 1895), which represents his whole statement of the subject, is given entire: "Professor Heer has described and figured a peculiar fossil which he regards as the fertile stipe of a fern and compares with the fertile frond of *Ophioglossum vulgatum*. Of this organism numerous examples have been found in the Amboy Clays, two of which are now figured. There can be no mistake about the identity of the plant, but as to its true character there may be great differences of opinion. Most of the specimens show at the base of an ament-like fruit spike one or more slender linear leaves or bracts, which evidently spring from the same stem. These leaves are sometimes as long as the fruit spike or longer, *and to me they seem like the male ament of a conifer rather than the fruit of a fern*."*

Extended comment is unnecessary. This shows conclusively that Newberry had correctly diagnosed the probable biologic affinity of the organism and simply wished to call attention to the fact that the Patoot beds of Greenland and the Amboy Clays of New Jersey held this species in common. That this correlation is probably correct is attested by a much larger series of specimens than passed under the observation of Doctor Stopes.

* The italics are the reviewer's.

Toward the close of her paper Doctor Stopes indulges in what she is pleased to call certain "moral reflections as to the value of most determinations of fossil plant impressions," and is distressed to conclude that many of these determinations are wholly without proper biologic authenticity. As a means for separating the sheep from the goats Doctor Stopes proceeds as follows: "It seems a good opportunity to urge that the lists published by paleobotanists should be printed in two forms, and that the names of species of leaves, stems, etc., of which there is a reasonable security of determination, should be differentiated from those in which there is no guarantee at all that the actual nature of the plant has been discovered. Any tri-nomial system is cumberous, but those who publish on fossil plants might print their names in type of two kinds, which would indicate which species were doubtful. I would like to suggest that, instead of using italic or ordinary capitals, as is usual in printing the names of species and genera, such doubtful plant impressions should be printed in Gothic lettering. This would indicate that our knowledge about them is mediaeval, of the Dark Ages, and would further save the inconvenience of tri-nomials, while it would indicate immediately the difference between the established and the doubtful determinations. As information occurred about a specimen it could readily be transferred to the clear Latin italics."

Applying this suggestion to *Ophioglossum granulatum* Heer, she adds: "Any worker in another branch of science, seeing **O. granulatum** in Gothic, would be warned at least to look into the grounds for the determination for himself before he—let us imagine—used the record for his stratigraphic work in correlating horizons or in writing up the early history of Ophioglossaceae."

This statement shows not only an astonishing misconception of what a tri-nomial means, and the principles and uses of stratigraphic paleobotany, but leads to interesting speculations as to the practical application of the plan. Suppose, for example, we have a fossil plant in which the genus is known with practical certainty, but we are troubled to decide whether the species is a living one (such an example is afforded by the Fort Union *Corylus americana*). Shall we print the genus in Italic and the species

in Gothic? Suppose we can be certain that one of Heer's plants from Greenland is the same as one found in the Amboy Clays, but we are still in doubt as to the generic reference. Shall we write the genus in Gothic and the species in Italic? And, when all is said and done, who shall be the censor to pass upon the authenticity of the biologic references? Shall we have a high court of appeal to decide when a species is entitled only to Gothic type, or when it is to be permitted to graduate into Italic or full capitals?

Although Doctor Stopes has thoughtfully confined these "moral reflections" to plant impressions only, we can not help thinking that the proposed reform, if adopted, ought also to apply to genera or species founded or identified on internal structure. For instance, would it not be as well to print *Niponophyllum cordaitiforme* Stopes & Fujii in Gothic, pending the decision as to whether it belongs to the Araucarineae, Podocarpineae, Cycadaceae or Cordaitales? Or would it be out of place to "Gothicize" *Cretovarium japonicum* of the same authors until it can be determined whether it is a Monocotyledone or a Dicotyledone?—A. Hollick.

The Indiana Weed Book.—This work by W. S. Blatchley is a piece of botany segregated upon the basis of the subjects being troublesome to the crop grower. So much that can be said of weeds applies with more or less force to other plants that the discussion of the distribution of their seeds by winds, water, birds and passing animals becomes a bright chapter in plant ecology. In the classification of weeds into (1) those of the worst type, (2) less aggressive, and (3) comparatively harmless, the author has not overlooked the benefits that those pests confer by the green covers they provide and the stimulus for better tillage. Apropos of this there are many pages devoted to the best methods of weed extermination, beginning with "(1) Sow clean seeds" and running through crop-rotation, autumn plowing, fewer fences, spraying, etc., to "(15) Make botany a common school study."

Following directly upon this very practical portion, and all

sprinkled with the spice of poetry, is a consideration of the root, stem, leaf, flower, and fruit of weeds, thus preparing the student along strictly botanical lines for the use of the descriptive catalog that makes up the main portion of the work. As a rule the species—arranged by families according to Britton and Brown's Flora—are illustrated by cuts well chosen from many sources.

It is quite clear from this little book—deserving more than a paper cover—that weeds provide a subject of great variety for the study of plants in the many phases of their existence, whether that extends over only a few weeks or through many years. While written especially for Indiana the author has provided a handbook from which any one can gain an interesting and profitable familiarity with many of our more common plants.—B. D. Halstead.

Dunn, S. T., & Tutcher, W. J. Flora of Kwangtung and Hongkong (China). Kew Bull. Misc. Inf. Addit. Ser. 10: 1–370. Map. 1912.—Kwangtung contains about 68,000 square miles, about one half within the tropics. There is a moderate range in elevation, from sea-level to 3,000 feet, with a few higher mountains about which little is known. The area of Hongkong is only 30 square miles, largely hilly, but it has been carefully explored. Many parts of the mainland are imperfectly known, especially in the southwest; nevertheless, its flora has been more accurately ascertained than that of any other part of China. It may be summarized as follows:

	Families	Genera	Species
Dicotyledons	117	728	1,749
Monocotyledons	25	232	557
Gymnosperms	3	7	11
Pteridophytes	15	42	243
	160	1,009	2,560

The sequence and limits of families are those of Bentham and Hooker; had Engler and Prantl been followed, the number of families would be stated as 181. In practically all cases, the authors have adhered to the nomenclature of the Index Kewensis.

But the book is most noteworthy for other reasons. It is the first which a student of the flora of any province of China can use to identify its plants, for it is provided throughout with keys to families, genera, and species. Indeed, no similar work has yet been completed for any other part of the Far East. A quite unique feature is the combination, in certain cases, of genera of similar habit in a single key.*

The largest family is Leguminosae with 66 genera and 173 species; then follow in order Gramineae, 76 genera, 166 species; Cyperaceae, 21 genera, 126 species; Compositae, 50 genera, 117 species; Orchidaceae, 44 genera, 89 species; Euphorbiaceae, 33 genera, 88 species; Rubiaceae, 34 genera, 86 species; Urticaceae, 25 genera, 70 species; these families taken in the wide sense.

The nearest extra-Chinese regions to Kwangtung are Formosa on the east, the Philippines on the southeast, and Indo-China on the southwest. With the last the transition in floras is probably very gradual, as continues to be the case through Tonkin and Annam into Cochin-China and Cambodia. There is also great similarity between the floras of Kwangtung and Formosa, many of the differences being due to the high mountains of the latter. The distance from eastern Kwangtung to the nearest point in the Philippines is only two thirds of the width of the Chinese province, or one third the length of the Islands, but the flora of the two political divisions is quite different. For example, the numericial order of phanerogamic families in the Philippines is Orchidaceae, Rubiaceae, Leguminosae, together having about 750 more known species than Kwangtung; pteridophytes, also, are three times as numerous. An area less than twice as great cannot accountfor this; the explanation must be sought in higher mountains, and tropical profusion.

It has been found necessary to describe only 15 species as new. This is partly due to earlier publications by the authors themselves as well as by others, for Hongkong alone has 100 endemic species; in part it must be attributed to the fact that

[* By a curious coincidence, and in a widely separated locality, the same procedure has just been followed in the recent admirable flora of the pine barrens by Witmer Stone.—Ed.]

the plants have come from moderate elevations in one portion of a great continent. The work will be of much value to botanical workers in many countries other than that for which it is primarily intended.—C. B. ROBINSON.

SMITH'S BACTERIA IN RELATION TO PLANT DISEASES.*—This is the second volume of Dr. Smith's publication and follows the first after an interval of six years. The earlier part discussed the general properties of bacteria, the methods of bacteriological research and so on. It has also proved to be a store-house of useful data and bibliographies. The present volume deals more particularly with the problems of the bacterial pathology of plants, with special reference to the vascular diseases. A great deal of space is given to the consideration of such subjects as the channels of infection in plants, the nature of parasitism, immunity factors, the normal bacterial flora of higher plants, and plant hygiene. All of these topics and many more are handled in the author's chatty and interesting manner. His own high position in his science makes it possible for him to speak in a personal way of many things, for there are few phases of the subject that he has not studied in his long and active career. The difficulty he once found in obtaining recognition for the idea that bacteria may cause disease in plants is echoed in the following paragraph quoted from him.

"The objections to bacterial parasitism in plants have been objections coming from those not familiar with such phenomena, and we all know how difficult it is at first for new ideas to make their way. Such things could not happen because they had not come within the ken of the objector, or because the physical nature of plant-tissues offered (theoretically) an insuperable obstacle to their multiplication, or because plant juices were acid and all known bacteria required an alkaline medium, or because if such diseases existed, one would already have discovered them. All of these objections were the result of inductions based on insufficient evidence. A thousand observations, let us say, con-

* Smith, Erwin F. Bacteria in Relation to Plant Diseases, Vol. II, pp. 1–368. Publication 27, Vol. II, Carnegie Institution of Washington. 1911.

firmed them, but then the thousand and *first* upset them completely."

An English reviewer has objected to the amount of space given by Dr. Smith to the nitrogen bacteria, ginger-beer plant, etc., and also to the full abstracts of other investigators' papers. Now, it seems that neither of these objections is very serious for two reasons: first, the publications of the Carnegie Institution are not intended to be used as text-books by undiscriminating young students but are for specialists who can choose those things in a book that are of most use to them in their own immediate problems; secondly, very few of us are able to read foreign languages with such ease that we *prefer* to do so and, furthermore, to have these abstracts brought together in one place is a saving of time. The author's style of informal discussion increases the readableness of the book, a result not to be scorned even in a scientific publication.

On the whole one may say that this volume is one well worth reading by people interested in botanical, bacteriological or phytopathological matters even if a highly technical knowledge of these subjects is not possessed. To the specialist in this field it should be an inspiration and a mine of valuable data. It is hoped that a third volume will soon appear in which we may find the brilliant researches of Dr. Smith and his co-workers upon the plant tumors.—E. D. C.

PROCEEDINGS OF THE CLUB

March 27, 1912

The meeting of March 27, 1912, was held in the lecture room of the New York Botanical Garden at 3 P.M. Vice-President Barnhart presided. Forty persons were present.

The minutes of the meetings of February 28 and March 12 were approved. The resignations of Mrs. M. E. Soth and F. K. Vreeland were read and accepted and Dr. R. Ellsworth Call, Geo. E. Hastings, and Frank M. Wheat, of the DeWitt Clinton High School, New York City, were elected to membership.

The announced scientific program consisted of a lecture on "Organization of Pediastrum Colony" by Professor R. A. Harper. The lecture was illustrated with lantern slides.

Meeting adjourned.

B. O. Dodge,
Secretary

April 24, 1912

The meeting of April 24, 1912, was held in the Laboratory of the New York Botanical Garden at 3:15 P.M., Dr. W. A. Murrill presiding. Fifteen persons were present.

The announced scientific program consisted of a paper on "Plant Hairs," by Dr. William Mansfield.

The speaker exhibited a number of figures representing various types of plant hairs and showed how the four main types, simple, compound, septate and non-septate, could be made the basis of a key by which many species of plants could be identified.

Meeting adjourned.

B. O. Dodge,
Secretary

May 14, 1912

The meeting was held in the American Museum of Natural History at 8:15 P.M. President Burgess presided. Nine persons were present.

The scientific program consisted of an illustrated lecture on "Dr. Charles H. Shaw's Botanical Studies in the Selkirks," by Miss Caroline S. Romer.

Meeting adjourned.

B. O. Dodge,
Secretary

NEWS ITEMS

At a recent meeting of the New York College of Pharmacy the treasurer, Mr. C. O. Bigelow, introduced an amendment to the by-laws, at the request of Dean Rusby, providing for the appointment of an associate dean, in order that the dean might be

relieved of a great deal of minor detail work, which at present devolves upon him. In some strange way the daily press reported this as a resignation by Dr. Rusby of the dean's office, and this report has been widely copied in other periodicals. It is here worthy of note, that after several years' effort on the part of the authorities of the College of Pharmacy, they have at last succeeded in establishing, in addition to the two year course, designed to prepare students for the work of the retail pharmacy, an advanced course, consisting of four years' work, for which the degree of Bachelor of Science in Pharmacy will be conferred by Columbia University. Two years of additional work will lead to the degree of Doctor of Pharmacy, which places the degree on the same professional footing as that of M.D. This arrangement has been approved by the Education Department of the State of New York, and will hereafter constitute the state requirements for these degrees.

William Robertson Smith, since 1854 superintendent of the National Botanic Garden at Washington, D. C., died on July 7th. He was born at Athelstone Falls, Scotland, March 21, 1828, and came to this country from the Royal Botanic Gardens at Kew, in 1853. Ever since he has been prominently identified with the National Botanic Garden, which holds a unique position among botanic gardens in this country. Mr. Smith possessed what is probably the finest collection of Burnsiana extant.

Prof. F. E. Lloyd until recently professor of botany at the Alabama Polytechnic Institute has been appointed professor of botany at McGill University, Montreal. Prof. Lloyd, who is now carrying on research work at the Carnegie Institution at Tucson, will begin work at his new post about September 1st.

An interesting acquisition to American botanical libraries is the recent purchase by the New York Botanical Garden of a copy of "Jacquin's Selectarum Stirpium Historia Iconibus Pictis." This, said to be the most valuable single volume in modern botanical literature, contains 264 colored plates, and descriptions of many tropical american plants. Only 12 or at least not more than 18 copies of this work were ever printed.

The edition which has been acquired by the New York garden was issued about 1780 or 1781. Only one other copy is known in America, at the Library of Congress at Washington.

Dr. E. de Wildman, for many years connected with the botanic garden at Brussels, and well known for his studies on economic botany and the flora of Tropical Africa, has been appointed director of the garden.

We learn from the *Sun* that on the 24th of July, Prof. J. A. Paine died at Tarrytown, N. Y., after several years of rather poor health. He was born in Newark, N. J., January 14, 1840. Prof. Paine specialized in botany and biology and was employed by the Board of Regents of the State of New York in connection with the flora of the State in 1862–67.

In 1867–69 he was professor of natural science in the Robert College (Congregational) in Constantinople, Turkey, and during 1870–71 professor of natural history and German in the Lake Forest University in Illinois.

During 1871–72 he was the editor of the *Independent* in New York and in 1872–74 he went with the first expedition of the Palestine exploration society east of the Jordan and Red Sea in the capacity of archeologist. One of his best known botanical works was a "Catalogue of Plants found in Oneida County and vicinity," printed in 1865.

On Thursday evening, August first, twelve botanists were the guests of Dr. N. L. Britton at a dinner given in honor of Dr. Chas. E. Bessey. After a walk through the grounds and conservatories of the New York Botanical Garden the party dined at L'Hermitage, where congratulatory speeches were made by several of the company after Dr. Bessey's speech to the toast "Nestor of American Botany."

The advantages of originally publishing such items in a magazine devoted solely to the science of botany, and also the protection afforded American botanists from prematurely or incorrectly published press dispatches, are features which, it is hoped, will be found sufficiently attractive to ensure hearty coöperation.

TORREYA

September, 1912

Vol. 12 No 9.

THE DETERMINATION OF WOODS *

By Chester Arthur Darling

As an introduction to this key to the commercial timbers it seems desirable to give a few directions and to define a few terms. The wood of a tree, like the leaves, is often variable; this variation is seen in the width of the growth rings, in the texture, and in the color of the wood which may be due to its being either sap or heart wood or to the length of time that it has been exposed after being cut.

For determination of any wood, a sample at least an inch square in cross section and three inches in longitudinal section should be used; a larger piece often shows the characters better than a small one. In using the key a hand lens which magnifies at least four times and a sharp knife which will make a clean cut surface in cross section of the wood without tearing the tissue are necessary. Unless otherwise indicated the section cut crosswise of the grain is the one to be examined. When color is to be determined the longitudinal section which has been freshly cut and not the cross section should be used; it is always best to test for color by placing the wood against a white surface.

Growth rings are indicated by parallel markings more or less curved which are seen on the cross section of the wood, usually varying in width from $\frac{1}{32}$ in. to $\frac{1}{4}$ in.; in the cross section of the tree they appear as concentric rings. Where there are parallel markings of two distinct types alternating, one of harder or more compact wood than the other, the two taken together

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* Suggestions for improving the key as well as corrections and additions will be gladly accepted; specimens of wood may be obtained upon request; additional copies of the key may be secured for 10 cents by addressing the author at Columbia University, New York City.

indicate a single growth ring; the inner part of the segment of the ring which is either more porous or less compact indicates the spring wood, while the outer portion which is often less porous or more dense is the summer wood; each growth ring is made up of both spring and summer wood, the inner part always being the spring wood. In some of the pines the spring and the summer wood are distinguished from each other as two distinct bands; whereas in some woods there is a gradual transition from the spring to the summer, and in still other cases there is no apparent difference between the two.

The pith rays always appear as lines of compact wood in the cross section extending at right angles to the growth rings; in longitudinal radial section they appear as smooth patches at right angles to the parallel bands of the spring and summer wood. When the pith rays are very small, wetting the cross section will often cause them to be more easily seen.

The pores are small openings usually no larger than that caused by the prick of a pin; they are plainly visible with a magnifier on a cross section which is clean-cut, in some cases they may be seen without the aid of a magnifier. In the Black Locust and sometimes in the Thorny Locust these large pores are filled with cellulose material. The pores in the summer wood arranged *radially* will be at right angles to the growth rings, whereas those arranged *concentrically* will be parallel to the growth rings. To determine *a* or *b* of 19 it is always desirable to make as thin a cross section as possible with a sharp knife, hold the section up to the light, and by looking through it one can easily determine whether or not the cells are arranged in regular rows.

Resin ducts appear as very small dots in cross section; the surface of the wood must be clean-cut without any tearing of the tissue in order that one may be sure of the presence of the ducts; it is usually best to wet the wood *after* making the section, since wetting will cause the duct to be more easily seen. It is usually of a lighter color than the surrounding wet tissue.

The characteristics of odor and of taste can be used to advantage only after one has handled different kinds of wood; a *characteristic* odor or taste refers to one which is not commonly

found in many woods. As to the texture, whether hard or soft, experience again is the best guide; however if a wood can be easily indented with the finger nail it may be called a soft wood; weight as here used is comparative and can be determined only by using different kinds of wood. As in the use of any key the more one knows, the easier it is to use.

In using the key always begin with number 1, read both *a* and *b*; after determining in which group the particular specimen belongs turn to the number indicated and read both *a* and *b*, choosing the one which best describes the specimen; continue this process until the name is secured. Accuracy in observation and in following the key is of first importance.

1 *a*. In smooth cross section growth rings are conspicuously marked by a zone of large pores collected in the spring wood, alternating with a zone of denser summer wood with smaller pores; pores usually visible without magnifier. . . . . 2.

b. In smooth cross section the growth rings are not marked by a zone of large pores in the spring wood as in *a*. . . . . 15.

2 *a*. Pith rays comparatively broad, at least as broad as the large pores, conspicuous without magnifier; radiating and branching lines or patches in the summer wood. . . . . 3.

b. Woods not completely as in *a*. . . . . 4.

3 *a*. Wood with reddish tinge. . . . . **Red Oaks.** (*Quercus.*)

b. Wood dingy, not with reddish tinge. . . . . **White Oaks.** (*Quercus.*)

4 *a*. Wood golden-colored or yellowish-brown; numerous smaller pores in summer wood appearing, without magnifier, as lighter colored specks or lines. . . 5.

b. Wood not golden or yellowish. . . . . 6.

5 *a*. Pores in summer wood single or in small groups, not in conspicuously concentric lines; pith rays fine, conspicuous only with magnifier; large pores often filled. **Black Locust.** (*Robinia pseudacacia.*)

b. Pores in summer wood usually in clusters appearing as irregular, concentric lines; pith rays conspicuous without magnifier. . . . . . **Mulberry.** (*Morus.*)

6 *a*. Wood reddish, pink, or salmon-colored; pores in summer wood conspicuous, often arranged in irregular concentric lines; pores in spring wood usually in two or more rows, the large pores sometimes filled.
Thorny Locust. (*Gleditsia triacanthos.*)

b. Wood not completely as in *a*. . . . . 7.

7 *a*. Pores in summer wood small, appearing as conspicuous concentric, wavy lines, sometimes continuous, often rail-fence like; wood comparatively light in weight. . . . . 8.

b. Pores in summer wood not completely as in *a*. . . . . 9.

8 *a*. Wood greenish-white; the large pith rays often as broad as the large pores.
Hackberry. (*Celtis.*)

b. Wood not greenish-white; pith rays not as broad as the large pores.
Elm. (*Ulmus.*)

9 *a*. Numerous fine straight, concentric lines nearly as distinct as the pith rays appear in the summer wood; pores often with a wall lighter colored than the surrounding tissue; wood heavy and hard....... **Hickory.** (*Hicoria.*)

b. Wood not completely as in *a* .... 10.

10 *a*. Pores in summer wood very small, appearing as radial branching lines or spots, often indistinct; pith rays very fine, usually visible only with the magnifier............................ **Chestnut.** (*Castanea dentata.*)

b. Pores in summer wood appearing as spots or as short broken lines, *not* radially arranged.. 11.

11 *a*. Wood when wet has a characteristic odor and taste; wood light. **Slippery Elm.** (*Ulmus fulva.*)

b. Wood not completely as in *a*.................................... 12.

12 *a*. Wood red; pores in summer wood not arranged in lines, usually separate. **Coffee Tree.** (*Gymnocladus dioica.*)

b. Wood not completely as in *a*.................................... 13.

13 *a*. Wood comparatively light; pores in spring wood large and numerous, usually in three or more rows, sometimes filled; pores in summer wood often several together........................ **Catalpa.** (*Catalpa Catalpa.*)

b. Wood not completely as in *a*.................................... 14.

14 *a*. Wood whitish; large pores in spring wood comparatively few, usually occupying not more than one third of the ring. **White Ash.** (*Fraxinus americana.*)

b. Wood brownish; large pores in spring wood comparatively numerous, often occupying one half of the ring........ **Black Ash.** (*Fraxinus nigra.*)

15 *a*. Pores usually visible without magnifier, generally scattered through the ring but more numerous and larger in the spring wood, gradually varying to smaller ones in the summer wood................................ 16.

b. All pores small or minute, rather evenly distributed, usually visible only with magnifier... 19.

16 *a*. Pith rays comparatively broad, the largest often twice as broad as the largest pores; pores often arranged in radial lines or patches. **Live Oak.** (*Quercus virginiana.*)

b. Wood not completely as in *a*.................................... 17.

17 *a*. Wood dark chocolate brown............ **Black Walnut.** (*Juglans nigra.*)

b. Wood not dark chocolate brown, usually light brown to whitish; fine straight concentric lines appear in the summer wood........................ 18.

18 *a*. Wood comparatively hard and heavy; large pores with a wall lighter colored than the surrounding tissue................... **Hickory.** (*Hicoria.*)

b. Wood comparatively light; large pores not as in *a*. **Butternut.** (*Juglans cinerea.*)

19 *a*. Cells of different sizes, not arranged in regular compact radial rows as seen in thin cross section, sometimes visible without magnifier; pith rays often visible even without magnifier; growth rings sometimes indistinct. 20.

b. All cells of uniform size arranged in regular radial rows or tiers as seen in a thin cross section; pith rays very fine; growth rings always distinct, the summer wood often much harder than the spring wood............ 34.

20 *a*. Wood reddish-brown, streaked with irregular darker colored streaks or lines;

pores and pith rays very small often indistinct even with the magnifier; growth rings often inconspicuous.

Sweet Gum, Red Gum. (*Liquidambar Styraciflua.*)

b. Wood not completely as in *a*....................................21.

21 *a.* Pith rays scarcely visible even with magnifier; wood soft and light, often whitish, usually with a silky luster in a freshly-cut cross section; pores numerous and scattered......**Cottonwood. Willow.** (*Populus. Salix.*)

b. Wood not completely as in *a*. ....2.

22 *a.* Pith rays conspicuously varying in width in cross section, some half as broad as others, the rays usually conspicuous without magnifier; wood usually hard and heavy..23.

b. Pith rays not conspicuously varying in width as in *a*..................25.

23 *a.* Wood appears mottled on radial section; pores usually visible without magnifier; wood usually vinous red.....**Sycamore.** (*Platanus occidentalis.*)

b. Wood not completely as in *a*..24.

24 *a.* Wood with a reddish tinge; broad pith rays numerous.

Beech. (*Fagus grandifolia.*)

b. Wood whitish; broad pith rays not numerous; growth rings usually wavy.

Blue Beech. (*Carpinus caroliniana.*)

25 *a.* Wood usually greenish-white, sometimes whitish when newly cut; pores. small, numerous, crowded; wood light.

White Wood. Tulip Poplar. (*Liriodendron tulipifera.*)

b. Wood not completely as in *a*..26.

26 *a.* Wood usually light brown, sometimes whitish when newly cut; pores small, not crowded; wood comparatively soft and light.

Basswood. (*Tilia americana.*)

b. Wood not completely as in *a*..27.

27 *a.* Wood usually vinous red; pores numerous, scattered, conspicuous with magnifier, sometimes without; pith rays give a silvery grain on the radial section..................................**Cherry.** (*Prunus serotina.*)

b. Wood whitish, yellowish, or reddish; pores few; pith rays often appear as reddish patches on the radial section............................28.

28 *a.* Pith rays about as broad as the largest visible pores, plainly visible in cross section without magnifier; on radial section the largest pith rays appear about $\frac{1}{16}$ in. high; pores numerous and distinct...................29.

b. The broadest pith rays about half as broad as the largest visible pores, often visible on cross section only with magnifier; on radial section the largest pith rays appear about $\frac{1}{32}$ in. high; pores often appear as whitish specks on cross section especially when wood is wet; wood usually of fine texture.

30.

29 *a.* The largest pith rays broader than the large pores; wood heavy and hard.

Hard Maples.

b. The large pith rays about the same width as the large pores; wood of medium weight and texture..................................**Soft Maples.**

30 *a.* Wood with reddish tinge...31.

b. Wood not with reddish tinge, either whitish, yellowish, or light brown....32.

31 *a.* Pores arranged in radial lines or patches; wood very hard and heavy.

Ironwood. (*Ostrya virginiana.*)

b. Pores scattered, not arranged as in *a*; wood of medium weight.
Red and **Cherry Birch.**

32 *a.* Growth rings very indistinct; pores minute and scattered.
Tulepo. Sour Gum. (*Nyssa sylvatica.*)

b. Growth rings clearly marked .... 33.

33 *a.* Wood distinctly yellow; pores numerous occupying nearly all of the space; wood light .... **Buckeye. Horse Chestnut.** (*Æsculus.*)

b. Wood whitish; pores occupying not over half the space; wood of medium weight .... **Gray Birch. White Birch.**

34 *a.* In freshly cut longitudinal section wood is decidedly chocolate-colored, reddish, or reddish-brown, not merely tinged with red; resin ducts always wanting .... 35.

b. Wood not completely as in *a* .... 37.

35 *a.* Wood with lead-pencil-like odor; wood comparatively heavy, hard and compact, fine grained .... **Red Cedar.** (*Juniperus virginiana.*)

b. Wood comparatively light and soft .... 36.

36 *a.* Wood reddish-brown, not with characteristic resinous odor.
Redwood. (*Sequoia.*)

b. Wood light chocolate brown with a characteristic, resinous, shingle-like odor.
Canoe Cedar. Incense Cedar. (*Thuja. Libocedrus.*)

37 *a.* Wood decidedly white in freshly-cut longitudinal section, comparatively soft and light .... 38.

b. Wood usually straw-colored or tinged with red, not noticeably white..... 39.

38 *a.* A few small resin ducts present appearing as specks in smooth cross section when wood is wet .... **White** or **Black Spruce**. (*Picea.*)

b. Resin ducts wanting .... **Balsam Fir.** (*Abies balsamea.*)

39 *a.* Transition from spring to summer wood (not summer to spring) more or less abrupt; bands of summer wood marked from bands of spring wood by fairly well defined lines .... 40.

b. Transition from spring to summer wood gradual .... 49.

40 *a.* Resin ducts wanting .... 41.

b. Resin ducts present, seen as specks especially in the bands of summer wood when wood is wet .... 43.

41 *a.* Wood light brown, with characteristic, resinous, shingle-like odor when wet.
White Cedars. (*Thuja. Chamaecyparis.*)

b. Wood not with characteristic odor as in *a* .... 42.

42 *a.* Growth rings usually variable in width; wood when fresh with a soapy or greasy character; summer wood straw color.
Cypress. (*Taxodium distichum.*)

b. Growth rings more or less regular in width; summer wood brownish.
Western White Firs. (*Abies.*)

43 *a.* On freshly-cut section wood has a characteristic, resinous, turpentine-like odor when wet; wood heavy, hard, and resinous, rather fine grained.
Longleaf Pine. (*Pinus palustris.*)

b. Woods not completely as in *a* .... 44.

44 *a.* Summer wood somewhat orange-yellow as seen in tangential section; growth rings regular in width often wavy in appearance; resin ducts usually oblong

in cross section, usually in groups, often not very distinct; wood with a rather characteristic odor when wet; western species.

Douglas Spruce. (*Pseudotsuga Douglasii.*)

b. Woods not completely as in *a*....................................45.

45 *a.* Average growth rings usually less than $\frac{1}{8}$ in. broad, more or less regular in width..46.

b. Some growth rings more than $\frac{1}{8}$ in. broad, often irregular in width....48.

46 *a.* Western wood; average growth rings about in. $\frac{1}{16}$ or less broad.

Bull Pine. (*Pinus ponderosa.*)

b. Eastern and southern woods; average growth rings more than $\frac{1}{16}$ in. broad. 47.

47 *a.* Wood noticeably reddish; transition from spring to summer wood often gradual in at least some of the rings.....**Red Pine.** (*Pinus resinosa.*)

b. Wood not noticeably reddish; transition from spring to summer wood abrupt.

Short-leaved Pine. (*Pinus echinata.*)

48 *a.* Bands of summer wood distinctly marked from bands of spring wood on *each* side; adjacent rings often variable in width; some resin ducts often oblong in cross section................**Loblolly Pine.** (*Pinus Taeda.*)

b. Some bands of summer wood distinctly marked from bands of spring wood only on *one* side of ring; resin ducts appear as circular dots in cross section; wood comparatively hard and heavy....**Tamarack.** (*Larix laricina.*)

49 *a.* Wood light brown, soft, light, with a distinctly resinous, shingle-like odor when wet; resin ducts wanting; summer wood darker than the spring wood.

White Cedars. (*Thuja. Chamaecyparis.*)

b. Wood not completely as in *a*....................................50.

50 *a.* Resin ducts present appearing as specks especially when wood is wet....51.

b. Resin ducts wanting, or not distinguishable........................57.

51 *a.* Growth rings usually variable in width; wood when fresh with a soapy or greasy character; summer wood straw colored.

Cypress. (*Taxodium distichum.*)

b. Woods not completely as in *a*....................................52.

52 *a.* Wood comparatively hard and heavy; some growth rings usually $\frac{1}{8}$ in. or more broad..........................**Tamarack.** (*Larix laricina.*)

b. Wood comparatively soft and light.................................53.

53 *a.* Wood with a decidedly reddish tinge on longitudinal section when dry, not merely red in summer wood....................................54.

b. Wood not noticeably red on longitudinal section......................55.

54 *a.* Eastern wood; transition from spring to summer wood often abrupt in some growth rings; sap wood often with bluish streaks.

Red Pine. (*Pinus resinosa.*)

b. Western wood; transition from spring to summer wood gradual in all of the growth rings.............**Western White Pine.** (*Pinus monticola.*)

55 *a.* Resin ducts comparatively large often darker than the wood; wood often stained around the resin ducts; summer wood noticeably harder and darker than the spring wood; western wood..**Sugar Pine.** (*Pinus Lambertiana.*)

b. Woods not completely as in *a*....................................56.

56 *a.* Growth rings about $\frac{1}{16}$ in. or more broad; resin ducts conspicuous when wood is wet; wood with pine odor when wet; eastern wood.

White Pine. (*Pinus Strobus.*)

b. Growth rings about $\frac{1}{32}$ in. broad; resin ducts very small, few; western wood. **Engelman's Spruce.** (*Picea Engelmanni.*)

57 *a*. Average growth rings less than $\frac{1}{16}$ in. broad; cells often just visible with the magnifier in cross section; western woods ....58.

b. Average growth rings more than $\frac{1}{16}$ in. broad ....59.

58 *a*. Very small resin ducts appearing as tiny specks in cross section when wood is wet ....**Engelman's Spruce.** (*Picea Engelmanni.*)

b. No resin ducts present ....**Red Firs.** (*Abies.*)

59 *a*. Wood whitish, comparatively soft and light; eastern wood. **Balsam Fir.** (*Picea balsamea.*)

b. Wood dingy colored or with reddish tinge ....60.

60 *a*. Growth rings regular in width, about $\frac{1}{8}$ in. broad; wood of fine texture; western species ....**Western White Firs.** (*Abies.*)

b. Growth rings usually variable in width; wood of rather coarse texture, often silvery on longitudinal section ....61.

61 *a*. Eastern wood; spring wood light-flesh-color when wet; wood splintery. **Eastern Hemlock.** (*Tsuga canadensis.*)

b. Western wood; spring wood dark-flesh-color when wet; summer wood buff-colored on radial section......**Western Hemlock.** (*Tsuga Mertensiana.*)

Columbia University.

THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Wilbur L. King

(*Continued from August* Torreya)

SCROPHULARIACEAE

Verbascum Thapsus L. In fields and waste places, Bethlehem. July 15, 1899.

Verbascum Lychnitis L. In fields and waste places. (Porter.) Fairly abundant along the Canal at Raubsville (J. A. Ruth)

Verbascum blattaria L. Common in fields and waste places, Bethlehem.

Linaria Linaria (L.) Karst. Common in fields and waste places, Bethlehem.

Antirrhinum Orontium L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull Torrey Club, **19**: 10. 1892.

Scrophularia marylandica L. In thickets along Lehigh River at Bethlehem. Aug. 5, 1899.

Scrophularia leporella Bicknell. In woods and along roadsides. (Porter.)

Chelone glabra L. In wet soil along Monocacy creek 2½ miles north of Bethlehem. Sept. 3, 1899.

Pentstemon hirsutus (L.) Willd. In dry soil ½ mile west of Freemansburg. May 29, 1897.

Paulownia tomentosa (Thunb.) Baill. Escaped from cultivation along towpath ½ mile east of Bethlehem.

Mimulus rigens L. In moist soil along Lehigh river near Bethehem July 15, 1899.

Mimulus alatus Soland. In swamps. (Porter.)

Gratiola aurea Muhl. In sandy wet places along Delaware river and at Bethlehem. (Porter.)

Ilysanthes dubia (L.) Barnh. In wet places. (Porter.)
Ilysanthes attenuata (Muhl.) Small. In moist soil on banks of Lehigh river, Bethlehem. Aug. 22, 1899.
Veronica Anagallis-aquatica L. In brooks and swamps along the Delaware river above Easton. (Porter.) In wet soil at Portland.
Veronica americana Schwein. In brooks and swamps. (Porter.)
Veronica scutellata L. In swamps. (Porter.)
Veronica officinalis L. In dry soil on Lehigh Mt.; also along Saucon creek. June 5, 1897.
Veronica serpyllifolia L. In woods near Lehigh University. (J. A. Ruth.)
Veronica peregrina L. Along roadsides, Bethlehem. May 20, 1900.
Veronica arvensis L. In woods on Lehigh Mt., altitude 850 feet. May 30, 1900.
Veronica agrestis L. On hillsides on Lehigh Mt. May 20, 1899.
Veronica hederaefolia L. In thickets, fields and waste places. (Porter.)
Leptandra virginica (L.) Nutt. In meadows, moist woods and thickets. (Porter.)
Dasystoma Pedicularia (L.) Benth. In rocky woods, Wind Gap. Aug. 27.
Dasystoma flava (L.) Wood. In woods on Lehigh Mt. July 20, 1899.
Dasystoma virginica (L.) Britton. In dry or moist woods. (Porter.)
Gerardia paupercula (A. Gray.) Britton. In bogs and low meadows along Delaware river above Easton. (Porter.)
Gerardia tenuifolia Vahl. In dry woods, Nazareth. Sept. 7, 1901.
Castilleja coccinea (L.) Spreng. In meadows in Lower Saucon township.
Pedicularis canadensis L. In woods on Lehigh Mt. May 20, 1899.
Melampyrum lineare Lam. In dry woods, Nazareth.

LENTIBULARIACEAE

Utricularia vulgaris L. In Lehigh river at Island Park. Aug. 25, 1902.
Utricularia intermedia Hayne. In shallow water. (Porter.)

OROBANCHACEAE

Thalesia uniflora (L.) Britton. In thickets along Lehigh river 1½ mile east of Bethlehem. June 3, 1899.
Orobanche minor J. E. Smith. Parasitic on roots of clover. (Porter.)
Leptamnium virginianum (L.) Raf. In beech woods. (Porter.)

BIGNONIACEAE

Catalpa Catalpa (L.) Karst. In wood land along Lehigh river between Bethlehem and Freemansburg. June 25, 1898.

ACANTHACEAE

Ruellia strepens L. In dry woods. (Porter.)

PHRYMACEAE

Phryma Leptostachya L. In woods on Lehigh Mt. near Lehigh University. Altitude 800 feet. July 1, 1899.

PLANTAGINACEAE

Plantago major L. In waste places, fields and lawns. Common.
Plantago Rugelii Dec. In fields, woods and waste places. (Porter.)
Plantago lanceolata L. In fields and waste places, Bethlehem.
Plantago aristata Michx. Adventive as a weed on campus of Lafayette College. (Porter.)
Plantago virginica L. In dry fields on Lehigh Mt. Altitude 850 feet. May 8, 1897.

RUBIACEAE

Houstonia coerulea L. In grassy fields near Bethlehem; also at Nazareth. Apr. 30, 1896.
Houstonia longifolia Gaertn. In dry open places. (Porter.)
Cephalanthus occidentalis L. In moist soil on Calypso Island. Aug. 7, 1900.
Mitchella repens L. In woods at Nazareth. June 15.
Diodia teres Walt. In dry or sandy soil. (Porter.)
Galium Mollugo L. In fields and waste places. (Porter.)
Galium Aparine L. In various situations; frequent at Bethlehem. (J. A. Ruth.)
Galium pilosum Ait. In dry or sandy soil. (Porter.)
Galium lanceolatum Torr. North of Bethlehem, June 16, 1905; on Lehigh Mt. near Lehigh University, 1891. (G. W. Caffrey.)
Galium circaezans Michx. North of Bethlehem, June 16, 1905. (G. W. Caffrey.)
Galium boreale L. In rocky soil or along streams. (Porter.)
Galium triflorum Michx. North of Bethlehem, June 16, 1905. (G. W. Caffrey.)
Galium Claytonii Michx. In meadows along Saucon creek two miles from its mouth. Sept. 4, 1900.
Galium asprellum Michx. In meadows along Saucon creek. Sept. 4, 1900.
Sherardia arvensis L. On ore dumps on Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.

CAPRIFOLIACEAE

Sambucus canadensis L. In fields and along Lehigh river; in Monocacy valley.
Sambucus pubens Michx. In rocky woods near Wind Gap.
Viburnum acerifolium L. In dry woods. (Porter.)
Viburnum pubescens (Ait.) Pursh. In rocky woods. (Porter.)
Viburnum dentatum L. In moist soil. (Porter.)
Viburnum Lentago L. In rich soil along Saucon creek.
Viburnum prunifolium L. In thickets along Monocacy creek. June, 1897.
Triosteum perfoliatum L. In rich soil. (Porter.)
Symphoricarpos racemosus Michx. In rocky places and on river shores. (Porter.)
Symphoricarpos Symphoricarpos (L.) MacM. Along rivers and in rocky places, escaped. (Porter.)
Lonicera dioica L. In rocky and usually dry situations. (Porter.)
Lonicera sempervirens L. In low ground or on hillsides. (Porter.)
Lonicera japonica Thunb. Escaped from cultivation. (Porter.)
Lonicera tatarica L. Escaped from cultivation. (Porter.)
Diervilla Diervilla (L.) MacM. In rocky situations on Lehigh Mt., June 16, 1905. (G. W. Caffrey.)

VALERIANACEAE

Valerianella Locusta (L.) Bettke. In meadows along Saucon creek. June 1, 1900.
Valerianella radiata (L.) Dufr. In wet meadows along Monocacy near Bethlehem, May 13, 1897; also along Saucon creek.

DIPSACACEAE

Dipsacus sylvestris Huds. In waste places. (Porter.)

CUCURBITACEAE

Micrampelis lobata (Michx.) Greene. In thickets and waste places. Bethlehem. Aug. 20, 1898.
Sicyos angulatus L. In moist places, Bethlehem. Aug. 12, 1899.

CAMPANULACEAE

CAMPANULA ROTUNDIFOLIA L. On moist rocks and in meadows. (Porter.)
CAMPANULA APARINOIDES Pursh. In wet meadows along Monocacy creek. Aug. 12, 1899.
LEGOUZIA PERFOLIATA (L.) Britton. In dry soil near Freemansburg.
LOBELIA CARDINALIS L. In moist soil near Nazareth.
LOBELIA SYPHILITICA L. In Saucon and Monocacy valleys, Oct. 3, 1896; also in moist soil at Island Park, Aug. 25.
LOBELIA SPICATA Lam. In fields between Bethlehem and Easton (J. A. Ruth); in dry rocky soil on Lehigh Mt., July 1, 1899.
LOBELIA INFLATA L. In dry fields, Bethlehem. Oct. 20, 1897.

CICHORIACEAE

CICHORIUM INTYBUS L. Along roadsides on outskirts of Bethlehem, it having been cultivated by the early Moravians; also at Island Park. Aug. 25, 1902.
CICHORIUM INTYBUS DIVARICATUM DC. Associated with the preceding.
LAPSANA COMMUNIS L. Along roadsides and in waste places, Easton. (Porter.)
ADOPOGON VIRGINICUM (L.) Kuntze. In woods on Lehigh Mt. near South Bethlehem. May 30, 1900.
ADOPOGON CAROLINIANUM (Walt.) Britton. In dry sandy soil.
LEONTODON AUTUMNALE L. In fields at Seidersville. (Bull. Torrey Club, **16**: 24. 1889.
LEONTODON NUDICAULE (L.) Porter. In waste places, Seidersville. (Britton & Brown Ill. Flora 3, **3**: 266.)
PICRIS HIERACIOIDES L. In waste places. Seidersville. Bull. (Torrey Club, **16**: 24. 1889.)
TRAGOPOGON PORRIFOLIUS L. In fields and waste places, Bethlehem.
TARAXACUM TARAXACUM (L.) Karst. Common everywhere.
TARAXACUM ERYTHROSPERMUM Andrz. In fields and roadsides, Bethlehem. May 4, 1902.
SONCHUS ARVENSIS L. In low grounds, fields and roadsides. (Porter.)
SONCHUS ASPER (L.) All. In fields and waste places. (Porter.)
LACTUCA SCARIOLA L. In fields and waste places, Bethlehem. Aug. 12, 1899. Some years ago it was very abundant in the Lehigh Valley in this and Lehigh county but for the last several years it has not been as plentiful.
LACTUCA CANADENSIS L. In moist open places. (Porter.)
LACTUCA SAGITTIFOLIA Ell. In dry open soil. (Porter.)
LACTUCA VILLOSA Jacq. In thickets. (Porter.)
LACTUCA FLORIDANA (L.) Gaertn. In moist open places. (Porter.)
LACTUCA SPICATA (Lam.) Hitchc. Along roadsides, Bethlehem. Aug. 12, 1899.
CREPIS VIRENS L. In fields and waste places, Easton. (Porter.)
CREPIS BIENNIS L. In waste places, Easton. (Porter.)
HIERACIUM PILOSELLA L. In door yards and fields, Easton. (Porter.)
HIERACIUM VENOSUM L. In woods on Lehigh Mt.
HIERACIUM MARIANUM Willd. In dry woods and thickets. (Porter.)
HIERACIUM SCABRUM Michx. In dry woods and clearings. (Porter.)
HIERACIUM GRONOVII L. In dry soil. (Porter.)
NABALUS ALTISSIMUS (L.) Hook. In woods and thickets. (Porter.)
NABALUS ALBUS (L.) Hook. In woods. (Porter.)
NABALUS SERPENTARIUS (Pursh.) Hook. In fields and thickets. (Porter.)
NABALUS TRIFOLIATUS Cass. In woods and thickets on Lehigh Mt.

AMBROSIACEAE

AMBROSIA TRIFIDA L. In moist soil, Bethlehem. Aug. 5, 1899. Also at Portland.
AMBROSIA TRIFIDA INTEGRIFOLIA (Muhl.) T. & G. In moist soil, Bethlehem.

Ambrosia artemisiaefolia L. In dry fields and waste places, Bethlehem. Aug. 30, 1898.
Xanthium spinosum L. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
Xanthium glabratum (D.C.) Britton. In waste places, Bethlehem. Oct. 1896.
Xanthium pennsylvanicum Wallr. In open places. (Porter.)
Xanthium echinatum Murr. On river shores. (Porter.)

COMPOSITAE

Vernonia glauca (L.) Britton. In thickets near Bethlehem. Sept. 7, 1899.
Eupatorium maculatum L. In moist soil. (Porter.)
Eupatorium maculatum amoenum (Pursh) Britton. In dryer places. (Porter.)
Eupatorium purpureum L. In moist soil. (Porter.)
Eupatorium trifoliatum L. In moist soil, Easton. (Porter.)
Eupatorium sessilifolium L. In dry woods. (Porter.)
Eupatorium verbenaefolium Michx. In moist soil. (Porter.)
Eupatorium perfoliatum L. In wet places along Monocacy creek.
Eupatorium ageratoides L. f. In woods on Lehigh Mt. Sept. 22, 1898.
Eupatorium aromaticum L. In rocky soil on Lehigh Mt. Sept. 22, 1898.
Mikania scandens (L.) Kuntze. In swamps and moist soil. (Porter.)
Kuhnia eupatorioides L. In dry soil. (Porter.)
Lacinaria spicata (L.) Kuntze. In moist soil. (Porter.)
Solidago squarrosa Muhl. In rocky soil. (Porter.)
Solidago caesia L. In woods and thickets on Lehigh Mt. Sept. 22, 1898.
Solidago flexicaulis L. In rich woods. (Porter.)
Solidago bicolor L. In dry shaded soil, Lehigh Mt. Sept. 22, 1898.
Solidago speciosa Nutt. On limestone rocks on both sides of Delaware river at Easton. (Porter.)
Solidago odora Ait. In dry soil. (Porter.)
Solidago rugosa Mill. In dry soil, Lehigh Mt. Sept. 22, 1898.
Solidago patula Muhl. In swamps. (Porter.)
Solidago ulmifolia Muhl. In woods and copses. (Porter.)
Solidago juncea Ait. In dry and rocky soil. (Porter.)
Solidago arguta Ait. In woods, Lehigh Mt. Sept. 22, 1898.
Solidago serotina Ait. In moist soil. (Porter).
Solidago serotina gigantea (Ait.) Gray. With the type. (Porter.)
Solidago canadensis L. Usually in dry soil. (Porter.)
Solidago canadensis scabriuscula (Porter.) (Porter.)
Solidago nemoralis Ait. In dry soil. Bethlehem.
Solidago rigida L. On limestone rocks on both sides of Delaware river at Easton. (Porter.)
Euthamia graminifolia (L.) Nutt. In fields, Bethlehem. Aug. 20, 1898. This plant is frequently infested with the black blister beetle.
Bellis perennis L. In waste places. (Porter.)
Sericocarpus asteroides (L.) B.S.P. In dry woods. (Porter.)
Aster divaricatus L. In shaded situations, Bethlehem. Oct. 1896.
Aster divaricatus cymulosus Burgess. In woods. (Porter.)
Aster Claytonia Burgess. In sunny or slightly shaded rocky places. (Porter.)
Aster curvescens Burgess. In loose moist shaded soil. (Porter.)
Aster Schreberi Nees. In borders of woods and shaded fence rows. (Porter.)
Aster macrophyllus L. In moderately dry soil and in shaded places. (Porter.)
Aster roscidus Burgess. In slight shade and in rich cleared soil or woodlands. (Porter.)
Aster cordifolius L. In woods and in dry soil, Bethlehem.
Aster cordifolius polycephalus Porter. At Easton, Oct. 1888. (Porter.)

ASTER CORDIFOLIUS LOWRIEANUS. (Porter.) In woods near Bethlehem and along Lehigh canal.
ASTER CORDIFOLIUS LANCIFOLIUS (Porter.) In woods. (Porter.)
ASTER CORDIFOLIUS BICKNELLII Porter. In woods. (Porter.)
ASTER SAGITTIFOLIUS Willd. In dry soil. (Porter.)
ASTER UNDULATUS L. In dry soil, Bethlehem. (J. A. Ruth.)
ASTER PATENS Ait. In dry soil, Bethlehem. Oct., 1897.
ASTER PHLOGIFOLIUS Muhl. In open woods between Bethlehem and Easton. July 12, 1905. (J. A. Ruth.)
ASTER NOVAE-ANGLIAE L. In fields and along swamps. (Porter.)
ASTER AMETHYSTINUS Nutt. In moist soil along Delaware river. (Porter.)
ASTER PUNICEUS L. In swamps. (Porter.)
ASTER PATULUS Lam. Bethlehem. (Porter.)
ASTER PRENANTHOIDES Muhl. In moist soil. (Porter.)
ASTER PRENANTHOIDES PORRECTIFOLIUS Porter. (Porter.)
ASTER LAEVIS L. Usually in dry soil. (Porter.)
ASTER LAEVIS AMPLIFOLIUS Porter. (Porter.)
ASTER RADULA Ait. In swamps. (Porter.)
ASTER ACUMINATUS Michx. In moist woods. (Porter.)
ASTER DUMOSUS L. In sandy soil, Bethlehem. (Porter.)
ASTER SALICIFOLIUS Lam. In moist soil. (Porter.)
ASTER SALICIFOLIUS SUBASPER (Lindl.) A. Gray. (Porter.)
ASTER PANICULATUS Lam. Along fences and fields. (Porter.)
ASTER PANICULATUS ACUTIDENS Burgess. (Porter.)
ASTER TRADESCANTI L. In fields and swamps. (Porter.)
ASTER ERICOIDES L. In fields along Monocacy creek.
ASTER LATERIFLORUS (L.) Britton. In dry soil near Bethlehem. Oct. 1896.
ASTER LATERIFLORUS GLOMERELLUS (T. & G.) Burgess. (Porter.)
ASTER LATERIFLORUS THYRSOIDEUS (A. Gray) Sheldon. (Porter.)
ASTER LATERIFLORUS GRANDIS Porter. (Porter.)
ASTER LATERIFLORUS HORIZONTALIS (Desf.) Burgess. (Porter.)
ASTER VIMINEUS Lam. In moist soil. (Porter.)
ASTER VIMINEUS COLUMBIANUS Britton. (Porter.)
ASTER MULTIFLORUS Ait. In dry open places. Abundant on both sides of Delaware river at Easton. (Porter.)
ERIGERON PULCHELLUS Michx. On hillsides along Monocacy valley two miles north of Bethlehem. May 12, 1897.
ERIGERON PHILADELPHICUS L. In fields and woods. (Porter.)
ERIGERON ANNUUS (L.) Pers. In fields, common. Bethlehem. July 10, 1899. At Portland, July 4, 1912.
ERIGERON RAMOSUS (Walt.) B.S.P. In fields. (Porter.)
ERIGERON ACRIS L. On ore dumps on Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
LEPTILON CANADENSE (L.) Britton. In dry fields, Bethlehem. Aug. 12, 1899.
DOELLINGERIA UMBELLATA (Mill.) Nees. In moist soil. (Porter.)
DOELLINGERIA INFIRMA (Michx.) Greene. In dry, usually rocky soil. (Porter.)
IONACTIS LINARIIFOLIUS (L.) Greene. In dry or rocky soil. (Porter.)
ANTENNARIA NEODIOICA Greene. In dry shady places. (Porter.)
ANTENNARIA NEGLECTA Greene. In fields and pastures. (Porter.)
ANTENNARIA PLANTAGINIFOLIA (L.) Richards. In woods, Lehigh Mt. April 28, 1897.
ANAPHALIS MARGARITACEA (L.) Benth. & Hook. In dry soil between Bethlehem and Nazareth and on Lehigh Mt. near Lehigh University, altitude 850 feet.
GNAPHALIUM OBTUSIFOLIUM L. In dry soil, Bethlehem.
GNAPHALIUM ULIGINOSUM L. In damp soil. (Porter.)
GNAPHALIUM PURPUREUM L. In dry sandy soil. (Porter.)
INULA HELENIUM L. On roadsides and infields. (Porter.)
INULA VISCOSA Desf. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club **19**: 10. 1892.
POLYMNIA UVEDALIA L. In rich woods near Easton. (Porter.)

Heliopsis helianthoides (L.) B.S.P. In open places. (Porter.)
Heliopsis scabra Dunal. Usually in dry soil. (Porter.)
Rudbeckia hirta L. In fields along Lehigh canal east of Bethlehem; on Lehigh Mt. ascending 850 feet; June 17, 1896.
Rudbeckia laciniata L. In meadows along Monocacy creek. Aug. 12, 1899.
Helianthus annuus L. In waste grounds; escaped. Bethlehem.
Helianthus petiolaris Nutt. In dry soil, Bethlehem. (Porter.)
Helianthus giganteus L. In swamps and wet meadows. (Porter.)
Helianthus divaricatus L. In woodland, Lehigh Mt. July 23, 1911. Altitude 850 feet.
Helianthus decapetalus L. In moist soil along Lehigh river 1 mile east of Bethlehem. Sept. 4, 1899. At Portland, July 4, 1912.
Helianthus tracheliifolius Mill. In dry soil. (Porter.)
Helianthus strumosus L. In dry woods and on banks. (Porter.)
Helianthus strumosus macrophyllus (Willd.) Britton. (Porter.)
Helianthus hirsutus Raf. In dry soil. (Porter.)
Helianthus tuberosus L. In fields and along roadsides, Bethlehem. Sept. 7, 1899.
Verbesina alternifolia (L.) Britton. In rich soil. (Porter.)
Coreopsis tinctoria Nutt. In moist soil. (Porter.)
Coreopsis verticillata L. Escaped. (Porter.)
Bidens laevis (L.) B. S. P. In swamps along Monocacy creek. Sept. 28, 1896.
Bidens cernua L. In swamps along Monocacy creek near Bethlehem. Sept. 28, 1896. (J. A. Ruth.)
Bidens connata Muhl. In swamps and moist soil. (Porter.)
Bidens comosa (A. Gray) Wiegand. In wet soil. (Porter.)
Bidens discoidea (T. & G.) Britton. On the Delaware river above Easton. (Porter.) In moist soil along Lehigh canal between Bethlehem and Freemansburg. Sept. 4, 1899.
Bidens frondosa L. In waste grounds, Bethlehem. Sept. 4, 1899.
Bidens vulgata Greene. In moist soil. (Porter.)
Bidens bipinnata L. In moist soil along Lehigh canal east of Bethlehem. Sept. 4, 1899.
Galinsoga parviflora Cav. Along roadsides, Bethlehem. Oct. 20, 1897.
Galinsoga parviflora hispida DC. In waste places and along roadsides, Bethlehem.
Helenium autumnale L. In meadows and moist places along Monocacy creek, Sept. 5; at Island Park, Aug. 25; also in Saucon valley. Flowers generally infested by a small cuculio.
Achillea Millefolium L. In waste places, roadsides and fields, Bethlehem. Sept. 28, 1896. At Portland, July 4, 1912.
Anthemis Cotula L. In waste places, Bethlehem. July 10, 1899.
Anthemis arvensis L. In fields and waste places. (Porter.)
Chrysanthemum Leucanthemum L. In meadows and hillsides in Saucon and Monocacy valleys and in Lehigh valley. Ascends Lehigh Mt. 850 feet. June 12, 1896. At Portland, July 4, 1912.
Chrysanthemum Parthenium (L.) Pers. In waste places, escaped. (Porter.)
Chrysanthemum procumbens Rich. On ore dumps in Bethlehem Steel Co.'s yards. Reported in Bull. Torrey Club 19: 10. 1892.
Tanacetum vulgare L. Along roadsides. Escaped. (Porter.)
Artemisia annuua L. In waste places. (Porter.)
Artemisia vulgaris L. In waste places, Bethlehem. (Porter.)
Tussilago Farfara L. In damp, shaded soil, Bethlehem. April 27, 1897.
Petasites Petasites (L.) Karst. In waste grounds, Bangor. (Porter.)
Erechtites hieracifolia (L.) Raf. In woodlands, thickets and waste places. (Porter.) In woods near South Bethlehem. (J. A. Ruth.)
Mesadenia reniformis (Muhl.) Raf. In woods. (Porter.)
Mesadenia atriplicifolia (L.) Raf. In woods. (Porter.)

SENECIO OBOVATUS Muhl. In moist soil and on banks. (Porter.)
SENECIO OBOVATUS ELONGATUS (Pursh.) Britton. On moist shaded banks, Easton. (Porter.)
SENECIO BALSAMITAE Muhl. In dry and rocky soil. (Porter.)
SENECIO AUREUS GRACILIS (Pursh.) Britton. In meadows along Saucon creek two miles from its mouth May 12, 1896.
ARCTIUM MINUS Schk. In waste places, Bethlehem and Portland.
CARDUUS LANCEOLATUS L. In waste places, Bethlehem.
CARDUUS DISCOLOR (Muhl.) Nutt. In dry soil along roadsides and in fields between Bethlehem and Freemansburg. Sept. 4, 1899.
CARDUUS MUTICUS (Michx.) Pers. In swamps and moist soil. (Porter.)
CARDUUS ARVENSIS (L.) Robs. Along roadsides and fields, Bethlehem.
CENTAUREA CYANUS L. In waste places along Monocacy creek one-half mile north of Bethlehem. June 20, 1901.

SUMMARY

The following fifteen families are represented by twenty or more species in each family or an aggregate of 732 species. This is more than half the flora of the county, although it covers less than twelve per centum of the families. It will be noted that the Compositae and Graminae are the leading families.

	Number of Species
Naiadaceae	21
Gramineae	111
Cyperaceae	87
Polygonaceae	25
Caryophyllaceae	28
Ranunculaceae	27
Cruciferae	42
Rosaceae	35
Papilionaceae	50
Violaceae	20
Umbelliferae	28
Labiatae	49
Scrophulariaceae	33
Cichoriaceae	31
Compositae	145

The flora of the county is made up as follows:

Number of families represented	128
Number of genera represented	523
Number of introduced species	307
Total number of species	1.304

REVIEWS

Stone's Flora of Southern New Jersey*

Most botanists who see the work here described will doubtless be surprised to find that one of the best local floras ever published has been written by a man who is primarily an ornithologist, and issued by an institution which has not previously figured as a producer of botanical literature. As the book lacks a table of contents, a synopsis is subjoined which will probably give the reader a clearer idea of its scope than would the same number of words arranged in sentences.

* The plants of southern New Jersey, with especial reference to the flora of the pine barrens and the geographic distribution of the species. By Witmer Stone. Curator, Academy of Natural Sciences, Philadelphia. Ann. Rep. N. J. State Mus. **1910**: 21–828. *pl. 1–129*. Map. 1911. Ja 1912.

Perhaps the most noteworthy feature of the work, next to the profusion of original observations, is the emphasis laid throughout on natural geographical divisions based on soil and vegetation. The author here discards, though apparently not without some reluctance, the parallel transcontinental "life-zones" of his fellow zoölogists, and will perhaps be regarded by some of them as a heretic for daring to mention such a sharply defined and non-climatic geographical province as the coastal plain (whose significance was scarcely recognized by botanists up to about fifteen years ago, or by Stone himself until much more recently). As a partial justification of this seeming heresy he explains (pp. 42, 43) that perhaps the fall-line (the inland boundary of the coastal plain) has more effect on plants than it has on animals. (See also page 102.)

On page 42 the author expresses the opinion that because in the southern states "a great many coastal plain plants range far west of the fall-line," that line "is less potent southward." This conclusion is not well founded, though, for in Georgia for example there are scores if not hundreds of species of plants confined to the coastal plain which do not reach New Jersey at all; and the change in vegetation at the fall-line is just as notice-

able in the Carolinas and Georgia as it is in New Jersey, and perhaps more so than in Maryland and Virginia.

The area covered by the catalogue of plants is not quite coextensive with the coastal plain of New Jersey, but terminates at a county boundary about ten miles southeast of the fall-line (p. 40); an expedient justified by the fact that herbarium specimens collected in the counties through which the fall-line passes are in many cases not labeled with sufficient accuracy to indicate on which side of that important line they grew,* and the narrow strip of coastal plain thus excluded is probably too small to contain any characteristic species that are not represented in the rest of the area.

By directing attention primarily to the vegetation the author has divided his territory into five pretty well marked regions, instead of the two divisions of the geologists, or only one as the zoölogists would have it. The colored map at the beginning of the volume shows the boundaries of the pine-barrens and the salt marshes very clearly, but combines the other divisions of the coastal plain in one color (and errs in including the whole of Staten Island in the coastal plain).

The summary of the field work of the author and his associates, in the preface, is accompanied by a small map showing their routes of exploration, which illustrates a commendable tendency to study plants *along routes*, instead of *at localities* in the old-fashioned or traditional manner of systematists.

The statistical lists of plants in various parts of the introduction are of a type familiar in some of the more pretentious local floras, and as they are not summarized the longer ones make rather dry reading. In other words, the opportunity to make some interesting generalizations about the times of flowering, modes of dissemination, percentage of monocotyledons, families and genera most numerously represented or conspicuous by their absence, etc., in each list was not taken advantage of. But that is so rarely done, and there are so many other things of interest and value in the book, that it would be unfair to criticize such omissions, and this remark is inserted merely as a suggestion for the future.

* In this connection see Bull. Torrey Club **31**: 10. 1904.

No attempt is made to describe the vegetation of the whole area systematically (for sufficient reasons, which the author explains on pages 33, 70 and 71); but under three of the geographical divisions, namely, the pine-barrens, the middle district, and the strand, quite a number of the characteristic or more abundant or conspicuous species are classified by habitat; which perhaps had never been done before for the middle district and pine-barrens. The relative abundance of the plants in these lists is not indicated, and some of them are not arranged in any apparent order; but habitat lists are still somewhat of a novelty (probably 90 per cent. of these published in America up to the present time are less than 15 years old), and there are very few local floras as yet which treat them any more scientifically than this one does.

Nearly as much space is devoted to the pine-barrens as to the other four regions combined, for that is the most unique and at the same time the least disturbed by civilization. The author here points out (pp. 57–58, 72–75) how the boundaries of this region have been misinterpreted by previous writers. Some have treated the whole coastal plain as pine-barrens, while others—mainly geologists— have regarded the region in question as coinciding with the area underlaid by Tertiary formations. A few had already noticed that the southern and western portions of the Tertiary region of New Jersey are not to be classed as pine-barrens, but it seems to have remained for Professor Stone himself to make known (about ffve years ago*) the fact that between the pine-barrens and the coast, and extending some distance into the pine-barrens along the larger streams, is a strip of vegetation very similar to that of the middle district. This narrow belt of quasi-climax vegetation is not explained, but it probably owes its existence very largely to the protection from fire on one or both sides afforded by the waterways.†

On pages 73, 215, 402, 454, 485, and 802 one finds an idea that seems to be entirely new, namely, that on the larger streams the

* Proc. Phila. Acad. **59**: 452–459. 1907.

† See Bull. Torrey Club **38**: 515–525. 1911.

dams nearest the coast now seem to mark the dividing line between the pine-barren vegetation and that of the coast strip, especially in the case of water-loving plants. This accords very well with the belief recently expressed by the reviewer* that *pioneer* aquatic vegetation is commonly associated with *minimum* seasonal fluctuations of water, and *vice versa;* for seasonal fluctuations are of course least just above a dam or shoal or waterfall and greatest just below, and these dams have probably been in existence long enough for the vegetation to adjust itself pretty well to such conditions.

The vegetation of the pine-barrens, both upland and lowland, is distinctly of a pioneer type, with *Pinus rigida* the dominant tree. Among the less obvious floristic characters which distinguish it from that of the neighboring regions are abundance of monocotyledons, *Chamaecyparis*, *Rhynchospora*, *Gyrotheca*, *Lophiola*, *Utricularia* (p. 689), Melanthaceae, Orchidaceae (361) and Ericaceae (617), and scarcity or absence of *Equisetum*, *Pinus Virginiana*, *Juniperus*, *Carex* (285), *Hicoria* (398), *Fagus* (403), *Salix*, *Polygonum sagittatum* (426), *Ranunculus* (455), *Platanus* (475), *Crataegus*, *Impatiens* (545), *Viola*, *Liquidambar* (474), *Diospyros* (634), *Quercus Phellos* (474), *Prunus serotina* (492), *Cornus florida* (602), Liliaceae, native Cruciferae (462), Umbelliferae, Labiatae, Scrophulariaceae, spring flowers (453) and weeds. (Almost the same might be said of some of the pine-barrens of the southeastern states.) In the list of characteristic pine-barren plants on pages 77–78, 47 per cent. of the angiosperms are monocotyledons, and there are 11 species of Ericaceae and Vacciniaceae. Nine of the 13 Melanthaceae mentioned in the catalogue grow in the pine-barrens, and three of them are confined to that region and one nearly so.

On pages 81, 100 and 101 the author points out that the Middle district is not a mere "tension zone" between the pine-barrens and the Piedmont region, as was recently supposed, but has enough characters of its own to rank equally with the pine-barrens as a distinct geographical division. It includes all of

* Ann. Rep. Fla. Geol. Surv. **3**: 234, 237; Bull. Torrey Club **38**: 231–232; Torreya **11**: 233–234. 1911.

the Cretaceous and part of the Tertiary region of New Jersey, and is the northern analogue of the "Middle district" of South Carolina, as defined by geographers a century ago. Its soil being much richer than that of the pine-barrens, the area is now mostly under cultivation and pretty thickly settled, and natural vegetation is scarce (p. 82). The remaining forests are mostly deciduous, contrasting strongly with the evergreen pine-barrens. (See interesting notes on this point on pages 474 and 602.) Several isolated colonies of pine-barren (mostly bog) plants are known in this region (see p. 74, and several places in catalogue), and they are regarded, no doubt correctly, as relicts rather than as recent invasions, which is presumably true also of the numerous colonies of pioneer plants outside of the coastal plain in the states farther south. Only 22.4 per cent. of the angiosperms listed as characteristic of the middle district on pages 88–90 are monocotyledons; which is less than half the percentage for the typical pine-barren plants.

The short chapter on weeds (pp. 99–101) is very interesting. The author states there that such plants are comparatively rare and easily recognized in the pine-barren region, where they are chiefly confined to the vicinity of the older and larger settlements, where the native vegetation has been damaged or destroyed by civilization. Spontaneous encroachment of introduced plants upon ground occupied by natives is practically unknown. Several "native" species which behave like weeds in the pine-barrens are listed on page 100, but there seems to be absolutely no evidence that they are native in New Jersey or anywhere near there.

In the taxonomic catalogue, which makes up the greater part of the book, about 1,400 species of vascular plants are enumerated, and nearly half a page is given to each. It is not a regular descriptive flora, but keys to all the species are included (at the request of the Museum authorities, the author says on page 34), and these keys are not merely copied from other books, but show considerable originality. This work differs from nearly all other local floras of similar scope in excluding known introduced species from the catalogue proper—though many of them are mentioned

in the keys, for purposes of identification. This way of treating them corresponds with current ornithological usage, and is a decided improvement on the practice of most botanists. Since the author has gone ahead of his botanical predecessors to the extent of excluding species known to have been introduced from foreign countries, one can hardly criticize him for not going a step farther and excluding species which are commonly supposed —though sometimes on insufficient grounds—to be native in other parts of the northeastern United States, when there is no good evidence of their indigeneity in southern New Jersey. (Several examples are mentioned on page 100, and numerous others in the catalogue.*) He does indeed state in many such cases that the species in question can hardly be native in the pine-barrens, and implies that they might be equally foreign to the other parts of his territory.

The author's ornithological training is revealed in his methods of citation. Wherever a species has been transferred from one genus to another the author of the new binomial is ignored, a practice more justifiable under the "Rochester" rules of two decades ago, which gave absolute priority to specific and varietal names, than under the rules of botanical nomenclature now in vogue, which allow some classes of exceptions. Like most zoologists and some botanists, he decapitalizes all specific names, regardless of origin, and uses Roman numerals for volume numbers. (In citing periodicals in footnotes the year is often substituted for the volume number, as was the custom for a number of years with the proceedings of the institution of which he is curator.) Each species listed is accompanied by a citation of its original description and type-locality (these data not merely copied from another book, but verified from the originals in nearly every case; see p. 34), and references to the pages of a few previous floras of the same region where it is mentioned. If it has been listed under different names in any of these other works those names are also given. Every accepted species is also given an English name (a fictitious one if no *bona-fide* one is known), in which particular the author is again following ornithological usage.

* See also Bull. Torrey Club **35**: 352–353. 1908.

The best feature of the catalogue is the way in which the distribution of each and every native species is summed up with reference to the whole state, and correlated with habitats as far as possible. The author here shows a wholesome disregard for the fetters of tradition, and although full credit is given to previous writers (see p. 26), many questionable statements about the occurrence of certain species in southern New Jersey (*e. g.*, *Lophotocarpus*, *Dichromena*, *Aletris aurea*, *Chondrophora*) that have been handed down for generations and accepted without much question are rejected for lack of evidence, and many alleged distinct species proposed in recent years are relegated to synonymy, though not without some explanation. In the case of several of the rarer or otherwise noteworthy species there are interesting annotations, sometimes extending over more than a page (about three pages for *Schizaea* and six for *Corema*),* and often accompanied by references to biographical sketches of the persons who first found them in the state. The time of flowering is given in most cases, and finally the known localities in the region, always classified according to the five natural divisions.

On the whole, this catalogue gives all the information about the local distribution of the species that one could reasonably expect, and in that respect it is far ahead of most of the floras of states and smaller areas that have been published in recent years. It serves very nearly the same purpose for 1,400 northeastern plants that Mohr's Plant Life of Alabama does for 2,500 southeastern plants, and measures well up to the high standard for local floras suggested in a valuable unsigned editorial in the Botanical Gazette for May, 1896. The information about habitats is more satisfactory on the whole than that found in our manuals, which treat such matters altogether too lightly.

The whole treatise gives one the impression of being based on very thorough work, and leaving very little for future explorers

* On page 634 the author notes a very interesting geographical triple correlation between the persimmon, the opossum and the negro (not the city-dwelling but the rural or agricultural negro, whose northern range is more restricted). One can hear rumors of such a correlation in some of the southern states, and the reviewer was told as long ago as 1905 by Dr. Hollick while on a trip to the southern part of Staten Island that it holds even there; but it perhaps has never been so definitely expressed in print before.

of that region to do in the way of defining local distribution. Although the author has shown a most commendable conservatism in refusing to include species whose occurrence or taxonomic status is doubtful, he does not seem to have overlooked any important source of information, or to have rejected any recently described species without reasons that seemed sufficient to him. Persons who contemplate doing floristic work on a similar scale elsewhere in the near future would do well to take Mr. Stone's work for a model, and not allow themselves to fall short of his ideals.

From the little statistical summary on page 806 one can easily gather an interesting fact that is not mentioned anywhere in the book; namely, 36.6 per cent. of the angiosperms catalogued are monocotyledons. This is the largest proportion of monocotyledons in any equal area of dry land in North America, as far as known to the reviewer,* and indicates again the decided pioneer character of the vegetation of a large part of the area.

The bibliography contains 92 titles, with extended comments on some of the papers, and references to biographical sketches of some of the earlier authors. It is arranged chronologically or nearly so, and is probably nearly complete for the ground covered.

The index unfortunately is not up to the standard of the rest of the book, as it is almost confined to the accepted species in the taxonomic catalogue. Both technical and common names are included, but there is only one reference to each, synonyms seem to be ignored, and the species are not indexed separately except in a few of the larger genera. The names of botanists whose biographies are referred to in the same 666 pages, and some of the chapter headings in the first 100 pages, are also included. The bulk of the index would have been increased very little by including references to all the explorers of the region, especially those whose biographies are referred to in the bibliography; and perhaps not at all by including the plants mentioned in the introductory part. This, however, may be one of those too common cases where the index was prepared by some other person than the author.

* See Torreya 5: 207–210. 1905.

Last but not least are the 129 half-tone plates, representing over 350 species of plants. The book contains no list of these illustrations, but they may be classified approximately as follows: Photographs of vegetation, 3 per cent. (one of them is out of plumb, a very common but well-nigh inexcusable fault of half-tone cuts*); photographs of single plants in their native haunts (mostly by Bayard Long), 8 per cent.; photographs of whole plants removed from their natural surroundings (mostly by Stewardson Brown), 12 per cent.; photographs of fragments of plants (mostly pressed inflorescences of grasses, sedges and rushes), 34 per cent.; photographs of paintings of single plants by H. E. Stone, 31 per cent.; line-drawings of single plants (also by H. E. Stone), 12 per cent. The last three classes add little to existing knowledge, but they are useful for purposes of identification, like the keys, and they doubtless include some species which had not been figured before (outside of the small line-drawings in Britton & Brown's Illustrated Flora).

The book contains many other valuable features, which can hardly be mentioned in the brief space of a review. With such a splendid floristic foundation to build on, the time is now ripe for some ecologically-inclined botanist to make a detailed study of the vegetation of the same region, and thereby fill a long-felt want and perhaps win laurels for himself. It seems strange that more work like this of Stone's has not been done, especially in those parts of the country where botanists are most numerous and where some of them have ample leisure and resources.

Roland M. Harper

PROCEEDINGS OF THE CLUB

May 29, 1912

The meeting of May 29, 1912, was held in the laboratory of the New York Botanical Garden at 3:30 P.M., Vice-president Barnhart presiding. Twelve persons were present.

The minutes of April 24 and May 14 were read and approved.

* See Science II: **35**: 985. 1912.

Dr. R. A. Harper announced the death of Professor E. Strasburger.

A motion was carried instructing the officers of the club to nominate honorary members at the first fall meeting. On motion of Dr. Britton, Dr. Harper was invited to act with the committee.

Mr. B. O. Dodge referred to the recent death of Mr. Gustav L. Ramsperger, one of the oldest members of the club, and suggested that some action be taken in regard to the matter.

On motion of Mrs. Britton the chairman was requested to appoint a committee, with power, to prepare a suitable memorandum for incorporation in the minutes of the meeting, and the secretary was instructed to transmit a copy of the same to the family of the deceased.

The chairman appointed Dr. Hollick, Dr. Britton, and Dr. Rusby as such committee and they subsequently prepared the following memorandum:

The Torrey Botanical Club records with sincere sorrow the recent death, in the eighty-eighth year of his age, of Gustav Ludwig Ramsperger, who was elected to active membership in the Club on February 9, 1886.

Mr. Ramsperger was born in Germany, December 13, 1824; studied pharmacy as apprentice and assistant, and passed his final examination in 1850. In 1851 he came to America and opened a small drug store in Oliver Street. After a successful business career of sixteen years he acquired an interest in the Faber-Balluff pharmacy, on the corner of 6th Avenue and 38th Street, in which location he was equally successful and in a few years concluded to retire and devote himself to scientific work. He sold out his interest in the pharmacy, but shortly afterwards decided that he was too young to retire from active business and acquired a pharmacy in Brooklyn, at the corner of Fulton and Cumberland Streets, where he remained until he finally retired, on his sixtieth birthday.

Mr. Ramsperger held membership in the New York State Pharmaceutical Association, of which he was a charter member, and in the American Pharmaceutical Association, and was a

trustee and honorary vice-president of the New College of Pharmacy. He was also active in many literary, social, charitable and educational societies and institutions, as well as in those of science. He was also a member of the New York Botanical Garden and aided materially in its establishment and development.

To the members of the Torrey Botanical Club he will always be remembered as a genial companion and enthusiastic lover of plants, with whom it was both a pleasure and an inspiration to spend a day in the field.

N. L. Britton
Arthur Hollick
H. H. Rusby

Dr. Britton then brought up a preliminary report on the state of the Underwood Fund, and submitted the following resolution which was adopted:

Resolved: That Miss Caroline Coventry Haynes be and is hereby appointed a Committee to solicit and receive contributions to a fund to become the property of the Torrey Botanical Club and to be a permanent memorial of the late Lucien Marcus Underwood, the interest accumulating on said fund to be used by the Torrey Botanical Club to aid in the illustration of papers published in its *Bulletin*, Torreya, or *Memoirs*.

The application of Miss Jean Broadhurst for a grant from the Esther Herrman Fund was laid over, pending a more exact statement of the amount of money desired.

The first number on the announced scientific program consisted of a preliminary report on "The Genus *Tabebuia* in the West Indies," by Dr. N. L. Britton.

The paper when completed will be published in the *Bulletin*.

Mr. B. O. Dodge then gave a short account of certain features in the method of reproduction in *Ascobolus*.

Meeting adjourned.

B. O. Dodge,
Secretary

NEWS ITEMS.

For the meaningless last paragraph on the last page of August Torreya the following item should have appeared. The coöperation of botanists is requested in the attempt to enlarge the section of Torreya which is devoted to "News Items." This is the only American magazine devoted solely to botany which has regularly carried a news column. It is now proposed to enlarge this feature of the journal, so that everything of current interest in the botanical world may find permanent record in Torreya. Any changes in teaching staff, additions to equipment or endowment, explorations or botanical expeditions, and any other items of current botanical news will be welcome. The advantages of originally publishing such items in a magazine devoted solely to the science of botany, and also the protection afforded American botanists from prematurely or incorrectly published press dispatches, are features which, it is hoped, will be found sufficiently attractive to ensure hearty coöperation.

Attention is called to the fact that October first is the last day upon which manuscripts of the Local Flora Prize Essay will be received. Full details of this competition were published in Torreya for March.

On Saturday, August 24, Dr. and Mrs. N. L. Britton, accompanied by Mr. Stewardson Brown of the Academy of Natural Sciences at Philadelphia, sailed for Bermuda to continue studies on the flora of that island.

Early in September Dr. C. B. Robinson, who has been working on the family Vacciniaceae at the New York Botanical Garden, will start for the Philippines, to resume work on the flora of the archipelago.

Professor Hugo de Vries is to visit the United States this fall and will give a lecture September 12 for the Brooklyn Botanic Garden at 8.15 P.M. at the Academy of Music, Brooklyn on "Plant breedong in the Botanic Garden of Amsterdam.' On September 14, at 4 P.M. he will lecture at the New York Botanical Garden on "Experiments in Mutation."

TORREYA

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ON THE ORIGIN AND PRESENT DISTRIBUTION OF THE PINE-BARRENS OF NEW JERSEY*

By Norman Taylor

The peculiarly characteristic features of the pine-barrens of New Jersey have always attracted the interest of botanists and zoölogists. Indeed, the region is so unusual that the ordinary traveler is at once struck with the difference between these sandy plains and pine-tree vegetation, and the richer flora further north. The recent excellent flora[1] of this region by Mr. Witmer Stone has renewed interest in this botanically unique country.

The true limits of the pine-barrens are perhaps for the first time clearly drawn by Stone in this work, there having been previously considerable difference of opinion as to how far south in New Jersey the true pine-barren element extended. Formerly the pine-barrens were supposed to consist of all the remainder of the state south of their northern edge, but explorations of the botanists of Philadelphia have resulted in a final delimitation of this interesting region. The accompanying map (fig. 1) copied from Stone's book well shows the limits of the pine-barrens. The darker colored portion surrounding the white is not pine-barren in character, and maintains a very different flora from the pine-barrens.

"Some attempt has been made to correlate these areas or parts of them [the coastal plain, including the pine-barrens] with the underlying geological formation, but . . . such correlation is not

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* Investigation prosecuted with the aid of a grant from the Esther Herrman Research Fund, of the New York Academy of Sciences. (Brooklyn Botanic Garden: Contributions No. 4.)

[1] Stone, W. The plants of southern New Jersey, with especial reference to the flora of the pine-barrens. Ann. Rept. N. Jersey State Mus. **1910**: 25–828. Ja 1912.

possible."[2] Notwithstanding this assertion it is the belief of the writer that not only is such correlation possible, but that, in the end, it is doubtful if there be any explanation, other than a

FIG. I. Map of southern New Jersey. The unshaded area is all pine-barren; the shaded areas are not pine-barrens. Note the shaded areas along the coast and at Cape May. (From Stone's Flora.)

[2] Stone, W. *loc. cit.* 57.

geological one, that will successfully explain the peculiarly local, often endemic, nature of the pine-barrens.

Others have also sought geological explanation for the origin of this region, and one paleobotanist was the first to suggest the possibility of there being any relationship between the flora and the geology of southern New Jersey.[3] It was Hollick's suggestion that the pine-barrens are co-extensive with the Tertiary sands and gravels that Stone's work shows must be revised. Recent collections, the significance of which was, of course, unknown to Hollick in 1899, have led to the abandonment of his theory that the pine-barrens or "coniferous zone" are co-extensive with the Tertiary sands and gravels.

Much later, we find Harshberger[4] attributing the vegetation about the edges of the pine-barrens to the "post Pensauken uplift of the New Jersey geologists," which is perfectly correct. But he follows Hollick in saying that "the Tertiary soils extend southward along the Atlantic Ocean to Florida and are occupied by a pine-barren flora."[5] This, as Stone's work has shown, must be modified. But this statement of Hollick's, subsequently used in Harshberger's work, contains such a large measure of truth in relation to the origin of this unique region, that it is only to be abandoned upon presentation of a theory more nearly fitting the known facts. While the pine-barrens do occupy Tertiary soils, they do not occupy *all of them.* It is just this lack of co-extensiveness of the pine-barrens in New Jersey with the Tertiary that has led to Mr. Stone's scepticism, and to the present effort to sketch what the writer believes to have been the sequence of geological events that has resulted in the final limits of the pine-barrens.

[3] Hollick, A. The relation between forestry and geology in New Jersey. Am. Nat. **33**: 1–14, with map. 1899.

[4] Harshberger, J. W. Phytogeographic Survey of N. Am. 219. 1911.

[5] Harshberger, J. W. *loc. cit.* 218.

Geological History of the Pine-Barren Area[6]

Going back to the time when all the coastal part of New Jersey south of a line from Jersey City to Flemington (see fig. 1) was under water, owing to the last great general submergence of the continent, we find that during this period a great deal of erosion of the unsubmerged land took place. This sinking of the coastal part of New Jersey, and of course elsewhere, known to geologists as the Miocene sinking,[7] had a profound influence on the configuration of the lower part of the state. All the material from the north and northwest that was washed down, or eroded, went out with the water and was finally deposited over this submerged area, and this deposition went on for countless ages. Ultimately this Beacon Hill formation, as the geologists call the deposited material, became very thick, covering practically all the lower part of the state.

"After the deposition of the Beacon Hill formation, the area over which it had been spread was again elevated, and the history of the topography of all that part of the state, which was covered by the formation, . . . dates from this re-emergence of the surface covered by the Beacon Hill formation."[8] This emergence of the land is spoken of by geologists as the Post-Miocene uplift or Pre-Pensauken cycle of erosion. Whatever the terminology used, the result was to bring above water most of the land that had been previously submerged. Not quite all of it, however, for the land was not perfectly level, and only the highest portions came out of the water. Some of what is now the coastal strip of New Jersey, all the Cape May region and much of the lower Delaware Valley, was either not above water at all, or only slightly so, and in the latter case was soon considerably eroded. This cutting down of the emerged Beacon Hill by erosion, particularly to the south and east, was very great, so that finally it was a very different region from the great upland plain it is supposed to have been immediately after the Post-Miocene uplift.

[6] For help in criticising the geological discussion that follows, and for much previous assistance along similar lines I here gratefully express my indebtedness to Dr. Arthur Hollick.

[7] Salisbury, R. D. Geol. Survey of New Jersey 4: 92. 1892.

[8] Salisbury, R. D. *loc. cit.* 93.

This erosion of the Beacon Hill formation pictured above was brought to an end finally by the gradual subsidence of the whole region. Little by little the lower part of New Jersey sank so

FIG. 2. Map of southern New Jersey at the time of the Pensauken Submergence. All the dotted area was under water, including the Cape May region. The undotted area has not been submerged since upper Miocene times. (*From Salisbury. Geol. Survey N. J.* 4: *pl. 10.*)

that everything but the then upland Beacon Hill formation was submerged (Pensauken Submergence).[9]

The accompanying map (fig. 2) shows the extent of the sub-

[9] Salisbury, R. D. *loc. cit.* 129.

mergence, as everything covered by the dotted area was under water. The undotted light area was not submerged, and has never since been submerged. After an indefinite period of submergence the whole dotted area was again raised so that all of lower New Jersey as we know it to-day came out of the water. The Pensauken formation, which is the geologists' name for most of the material eroded from the uninterruptedly emerged Beacon Hill, was itself subject to erosion, giving us the present characteristic stream beds of the coastal plain in the state.

The next step of serious significance was the encroachment of the ice-sheet, which came down to Perth Amboy, not more than 12–20 miles north of the Beacon Hill formation. At the final recession of the ice there is some evidence of another slight subsidence of the lower part of the state and the coastal region, but not enough to have brought the Beacon Hill formation anywhere near down to sea level. This last subsidence of the coastal strip and the Cape May region had a significant influence upon the distribution of the plants of the area. It seems very probable that a gradual sinking of this region has been going on ever since, as the sea has constantly encroached upon the land throughout maritime New Jersey, as indeed it has in Staten Island, Long Island, and further north.

Whether one follows Johnson[10] in believing that this subsidence of the coastal part of our area is not recent or continuing; or Bartlett[11] that it is both recent and continuing, does not matter so much for our present purposes.[12] Both agree, and the evidence is of such a nature that it appears incontestable, that there was a great deal of ancient subsidence. In Cape May County this has been of such an extent that whole regions covered by forests of white cedar (*Chamaecyparis thuyoides*) have been submerged, emerged, and submerged again. This, repeated several times,

[10] Johnson, D. W. Botanical evidence of coastal subsidence. Science II. **37**: 721. 1910. Science II. **38**: 300. 1911.

[11] Bartlett, H. H. Science II. **37**: 29. 1910.

[12] The writer inclines to the views held by Mr. H. H. Bartlett in this very interesting question of coastal subsidence. Evidence of recent and progressive subsidence seems conclusive, quite apart from any question of fluctuating high tides, which seem to Dr. Johnson to be of so much importance.

has resulted in a great accumulation of buried forests. "Trunks of trees are found buried at all depths beneath the surafce, quite down to the gravel."[13] This and "numerous facts of the same kind . . . collected along the shores of the Delaware Bay and River, in Salem and Cumberland Counties, and on the sea-shore in Atlantic, Ocean, Monmouth, and Middlesex Counties,"[14] all seem to point to a decided ancient subsidence of the area surrounding the Beacon Hill formation.

For the phytogeographer the salient features of these changes are that Beacon Hill has been uninterruptedly out of the water since upper Miocene times, and that it has several times been partly, and often entirely surrounded by water. These facts, together with the encroachment of the glacier, and its recession, with the probable deposition of a great deal of morainic material around Beacon Hill, makes this formation the oldest in New Jersey, either on the coastal plain or in the glaciated regions northward, that could have been continuously covered with vegetation. This, it seems to me, is why the Beacon Hill formation is the controlling factor in the origin and present distribution of the pine-barrens. The area of the pine-barrens (see fig. 1) is not exactly coextensive with Beacon Hill (see fig. 2) but the differences are so slight that recent and local erosion of the formation would account for the failure of the two regions to superimpose, as it were.

In other words the New Jersey pine-barrens exist exclusively on this Beacon Hill formation, an area isolated by geological processes, and maintaining a relict or climax flora, the antiquity of which greatly antedates any of the rest of our vegetation hereabouts, so far as permanency of position and phytogeographical isolation are concerned. This undoubtedly accounts for the composition of the flora, and it is interesting to note that zoölogists have found this same apparent isolation, the same endemism noted above. The sphagnum frog, *Rana virgatipes*, described by Cope and collected only thrice since, is unknown outside of this region,[15] and the late John B. Smith in his work

[13] Geology of the county of Cape May 62. 1857.

[14] *Ibid.* 39.

[15] Fowler, H. W. Proc. Acad. Nat. Sci. Philadelphia **57**: 662–664. 1905.

on the insects of New Jersey has figured the "entomological pine-barrens" as very nearly coinciding with the floral pine-barrens.[16] I have not been able to find any explanation of these curious distributional features, by a zoölogist; but it would seem that perhaps the outline given above may also explain for them the endemism of the pine-barrens.

In the light of this historical outline it should be easy to trace the development of the pine-barren vegetation from the Miocene uplift until the present. Ancestrally it must have consisted of purely American plants, and most of these, in all probability, were of southern extraction.[17] Of the 565 species reported growing in the region, not counting weeds, 386 are listed as truly pine-barren. This does not mean that they are found nowhere else, but that so far as New Jersey is concerned these plants find their greatest development in the pine-barrens. There is a small element among them practically unknown outside of the pine-barrens of New Jersey, such as *Abama americana*, *Sporobolus Torreyanus*, *Eupatorium resinosum*,[18] *Chrysopsis falcata*, and *Juncus caesariensis*.[18] Besides these there are 12 species found predominately in this region, whose distribution is restricted from Massachusetts on the north to Delaware on the south, and whose undoubted distribution-centers are the pine-barrens.

It would seem likely that the 386 pine-barren species mentioned above which are now found elsewhere on the coastal plain have spread there since the release of the Beacon Hill formation from its last isolation. Perhaps future studies may be able to show, even in the pine-barrens themselves, a greater development of the typically endemic pine-barrens in the interior, than is found near the edges where the former and existing tension between other elements has left greater evidences.

At the advance of the ice there must have been a great invasion of northern species, many of which are still found in the pine-

[16] Ann. Rept. N. Jersey State Mus. 1909. Map (frontispiece). 1910.

[17] Over 180 species of the *present* flora range from Virginia to Florida and northward. Of these more than 70 find their northernmost limits in the pine-barrens. The others are found further north, into Massachusetts and Rhode Island. These and subsequent figures are from Mr. Stone's excellent tabulations.

[18] Apparently unknown elsewhere in the world.

barrens. If, as seems probable, no very great refrigeration took place in the area under consideration[19] it is within the realm of probability that the pine-barren vegetation existing then on the Beacon Hill formation, was not very seriously disturbed climatically. We have geological evidence that it was never subjected to any deposition of glacial material or over-wash; it contains no glacial terraces, for its elevation, perhaps greater then than now, precluded this. But the region surrounding Beacon Hill was in no such fortunate position. Having only recently emerged, comparatively, and boasting only a meager altitude it was more or less overrun with the material from the ice. The glacial terraces of the lower Delaware, the nature of the material deposited near Cape May and in Cumberland County all point to a local, or perhaps wide-spread subsidence of the region, which, however, did not affect the Beacon Hill formation as far as possible glacial influence is concerned. Furthermore, there is evidence in the sunken forests at Cape May mentioned above, and in the character of the present vegetation,[20] of the effects of the encroachment of glacial material from the north, by way of the Delaware Valley.

If the ice did not affect the pine-barrens geologically so much as it did the surrounding country, there seems little doubt that it was at this time that many additions were made to the flora of that region. All the following species, ranging as they do from the far north to the pine-barrens of New Jersey,[21] show unmistakable evidences of having come down with the glacier,

[19] This is a conclusion warranted by our knowledge of modern glaciers. While the refrigeration must be very great near the source of glaciers it is a well known fact that at the edges, refrigeration diminishes greatly, particularly where the ice is thin, as it was in all probability near the moraine in New Jersey. It is a common characteristic of glaciers that plants are found almost up to the edge of the ice and sometimes on it. See Muhlenbergia **7**: 103, 111, 121. 1912.

[20] Mr. Stone has collected many plants at Cape May unknown in the pine-barrens, and some not known elsewhere south of the "fall line." The present distribution of *Tsuga canadensis* in New Jersey is also probably attributable to the factors noted above. It is common along the drainage of the Delaware River in lower New Jersey (the region of glacial terraces) but unknown in the pine-barrens. It is, of course, common northward. See Stone, *loc. cit.* 93.

[21] Some are now found elsewhere in New Jersey, but, as I have shown above, probably because of their subsequent migration from Beacon Hill.

and of having become isolated in bogs and other edaphically favorable locations, such as probably were only to be found on Beacon Hill at that time: *Triglochin palustris*, *Panicularia obtusa*, *Scirpus subterminalis*, *Carex livida*, *C. exilis*, *Utricularia intermedia* and *Aster nemoralis*. There are a good many more,[22] and the same phenomenon has been noted by entomologists. Prof. Smith writes of *Trechus chalybeus*, and a few other insects, that "the only trace of real boreal species has been found in the deep cold swamps of Ocean County."[23]

In this connection the distribution of the most remarkable plant of the pine-barrens, *Schizaea pusilla* is very interesting. It is found only in the pine-barrens and in Nova Scotia and Newfoundland, and is unknown between these points. If Dr. Scharff's recently proposed theory[24] that perhaps parts of Nova Scotia and Newfoundland remained unglaciated through all the period of the Pleistocene is correct, then it is not impossible that *Schizaea* is a relict in the pine-barrens of its southern migration, and that it is also a relict in the north, all the intervening territory having been preëmpted first by the ice, secondarily by more "agressive" plants after the recession of the ice. This is little more than interesting speculation, but Scharff, whether wrong or right in his contention, has opened up a wide field of discussion. It is certainly significant that *Schizaea* is not found in the unquestionably glaciated country, and is found only in the pine-barrens and in the [probably] unglaciated northeast.

Another feature of the pine-barrens which may support the theory that they are a very ancient and isolated phytogeographical entity is the number of parasitic, saprophytic and mycosymbiotic plants that grow there. Cowles,[25] in his recent treatment of those plants not wholly dependent on their own roots for food, has made the suggestion that the origin of the parasitic, saprophytic, and mycosymbiotic habit may have

[22] Stone, W. *loc. cit.* 49, 50, and 76.

[23] Ann. Rept. N. Jersey State Mus. **1909**: 30. 1910.

[24] Scharff, R. F. Distribution and origin of life in North America. New York. 1912. For further data on this point see also Adams, C. C. The Post-glacial dispersal of the North American Biota. Rept. Int. Geog. Cong. **8**: 623–637. 1904.

[25] Coulter, J. M., Barnes, C. R., and Cowles, H. C. Text-book of Botany. **2**: Ecology, 775 and 799. 1911.

been mere chance at first, then increased perhaps by the greater ease of one species as against its neighbors in getting its food, or to the failure to get food without some such reciprocal relation. The inference that this non-autophytic habit is due to isolation and consequent necessity of seeking other than "regular" methods of getting food, in a region, perhaps ancestrally offering an inaccessible food supply, may not be without significance. It is certainly of interest in this connection to note the well known high percentage of monocotyledons,[26] Pinaceae, Fagaceae, Scrophulariaceae, and Ericales, all of which are mostly non-autophytic.[27] So far as Orchidaceae and some of the monocotyledonous families are concerned the number of *species* is disproportionately large as compared with the surrounding country. Among some families, Fagaceae, Pinaceae and Ericaceae for instance, it is the number of *individuals* that is so great, forming practically exclusive growths in the case of *Pinus rigida* and *Chamaecyparis thuyoides*. This very general prevalence of the non-autophytic habit may have had something to do with the failure of many wholly autophytic plants, surrounding the Beacon Hill formation, to gain a foothold there, for the mutual exclusiveness of the diverse habits is obvious. There may, however, have been quite other factors operative here than antiquity and isolation. It would be interesting in this connection to compare the flora of the pine-barrens with some other region of similar geological antiquity. The driftless area of Wisconsin seems, at first thought, to be similarly conditioned geologically, but there is evidence that it could not have been steadily vegetated during the Pleistocene, as it was covered by water during some part of this period.[28]

The extra-territorial distribution of some of the typical pine-

[26] Stone, W. *loc. cit.* 75. See also Harper, R. M. Torreya **12**: 224. 1912. Torreya **5**: 207–210. 1905.

[27] According to E. Stal (Der Sinn der Mycorhizenbildung, in Jahrb. Wiss. Bot. **34**: 539–668. 1900) in the following families many, if not all the species, are mychorhizal, Orchidaceae, Amaryllidaceae, Liliaceae, Caryophyllaceae, Saxifragaceae, Fagaceae, Papilionaceae, Gentianaceae, Ericaceae, Scrophulariaceae and Coniferae. There are many other individual cases.

[28] Chamberlain, T. C., and Salisbury, R. D. Driftless area of the Upper Mississippi Valley. Ann. Rept. U. S. Geol. Sur. **6**: 199–322. 1885.

barren flora contributes some data that support the views outlined above. Particularly the finding of *Xerophyllum*, *Helonias*, and *Oceanorus*, to mention only a few, on the mountains of eastern Tennessee, is of interest. These and many more were found by Kearney[29] and more recently by Small, in geologically the most ancient area in America (Archaean). The hiatus in the distribution of these plants between the pine-barrens and these very old mountains is easily explainable by the isolation theory above advocated. The fact that they are wanting or very rare in the intervening territory would seem to present strong evidence of the unavailableness of this intermediary area (most of it was under water), during the geological changes described above, for the perpetuation of the species now so far isolated. Furthermore this southern isolation strongly favors the statement made above that most of the pine-barren flora was of southern extraction, for it is quite reasonable that the species found on the Tennessee mountains and in the pine-barrens of New Jersey are simply relicts of an ancient American southern flora that must, at one time, have covered a vastly greater area than it does to-day. The present nearly complete isolation and the post-glacial distribution of this southern flora, both it seems to me, favor this view.

There remains still to be considered the "pine-barren" plants of Long Island and Staten Island, not to mention regions further east. As Stone has shown a good many of these alleged "pine-barren" plants are only coastal plain plants,[30] which are found, it is true, in the pine-barrens; but more commonly in the area surrounding them, frequently throughout the Atlantic seaboard from Massachusetts to Florida. It should be remembered in this connection that neither Long Island nor Staten Island are in the same geological category as Beacon Hill. For both the former were in part covered by the glacier and both were more or less within the influence of glacial activity.[31] It is, of course,

[29] The pine-barren flora in the East-Tennessee Mountains. Plant World **1**: 33–35. 1897.

[30] Stone, W. *loc. cit.* 73.

[31] Long Island was not covered wholly by glacial drift, but the sandy plain south of the moraine received considerable overwash material, now mixed with the underlying Tertiary sand and gravel.

a matter of pure speculation whether any vegetation persisted during the Pleistocene on Long Island or not, but evidence seems to point to the negative probability. If this is true then all of the New Jersey flora now found on Long Island must have had a post glacial origin. The distribution of *Pinus echinata*, *P. virginiana* and the red squirrel may throw some light on the post-glacial chronology of events on Lond Island. Both these pines are found in the region surrounding the pine-barrens, but are unknown, or very rare in them. *Pinus rigida* the predominant tree of the barrens is common on Long Island, but the two pines mentioned above and the red squirrel are not known on the island.[32] From the geological outline given above we know that *P. virginiàna* and *P. echinata* must have occupied the region surrounding the pine-barrens long after the last effects of the ice were past. This may also have been true of the red squirrel. At any rate, after a large post-glacial migration of alleged "pine-barren" plants, the avenue of migration must have been broken. The discontinuance of this passageway must, it seems to me, have been the controlling factor in the failure of *Pinus echinata*, *P. virginiana* and the red squirrel to reach Long Island. It is curious in this connection that both the pines, but not the animal, are found on Staten Island. The geological events causing this very decided cut-off are outside the scope of this paper. It may, however, have been something other than geological phenomena operating here. There are, of course, many more species than these pines, which apparently reach their northern distribution point in the region surrounding Beacon Hill, or in Staten Island, never having been reported from Long Island. It seems probable that they came northward in post glacial times, too late to avail themselves of the already destroyed avenue of migration.

One other extra-territorial occurrence of pine-barren species should be noted. A widely quoted paper of Britton's[33] is often cited in support of the theory that pine-barren plants are not

[32] The reported occurrence of *Pinus virginiana* in Suffolk Co., L. I., by Miller and Young cannot be verified. It was probably a misdetermination of *P. rigida*.

[33] Britton, N. L. On the existence of a peculiar flora on the Kittatinny mountains of northwestern New Jersey. Bull. Torrey Club **11**: 126–128. 1884.

strictly confined to their supposed home, and that their occurrence in edaphically favorable places in the Kittatinny mountains was an example of such phytogeographical instability. A careful reading of Dr. Britton's paper shows that not only did he make no such claim, but that all the plants mentioned there, with one exception, are not pine-barren plants, strictly speaking, at all. They are all merely plants of the sandy coastal plain, *Corema Conradii*, a true pine-barren plant, being the one exception. The distribution of this species and of the many others now found isolated outside of the pine-barrens, is to be sought in the post-glacial history of the region to the north. In the general vegetative scramble, so to speak, to cover the country uncovered by the retreating ice, it seems natural that those plants whose ancestral home had been in sand, should "choose" sand as a stopping place. It would, in reality, be strange if they had done anything else, and it is significant that all the plants mentioned by Britton are sand plants.

All of these evidences,—the geological history of the country, the isolation of Beacon Hill and the consequent isolation of the ancient pine-barren flora upon it, the post-glacial migration of some of the pine-barren species, and finally the present distribution of the pine-barrens, coinciding as it does so closely with the Beacon Hill formation, seem incontestably to point to a geological explanation of the origin and present distribution of the pine-barrens. Such a conception of the origin of this phytogeographical region entails a readjustment of our ideas as to the relative age of the flora and of some related phenomena; for, if this theory is correct, then the pine-barrens can no more be considered as a new or pioneer vegetation, but rather as an old and climax condition, ancestrally infinitely more ancient than anything in the surrounding area.

Brooklyn Botanic Garden

A FEW NOTES ON THE CHEMICAL COMPOSITION OF BEE BREAD

By Ruth L. Phillips

During the past year I have been studying the growth changes in the nerve cells of the honey bee, *Apis mellifica.* Since nutrition plays a very important part in such changes throughout the life history of the insect I was interested to ascertain the chemical composition of the nitrogenous food of bees. This is popularly called bee bread, and consists mainly of the different kinds of pollen collected by the insects on their foraging expeditions which is mixed with a small amount of honey and wax. Such pollen is probably representative, in its chemical content, of pollen in general. Therefore I am giving the results of the chemical analysis in case they might prove interesting to botanists.

The time at my disposal was not long, so it was impossible to make more than one analysis, but still this represents, in the main, several analyses, as each determination represents the average of a series, several samples being taken and the final results computed as the averages of these. Therefore, with the exception of the wax to which I will refer later, the following figures represent approximately the composition of such pollen as is stored by the average hive of bees in mid summer. The sugar content is undoubtedly high for pure pollen since a certain amount of honey is used in making the bread.

Bee bread and bee's wax both oxidize at a low temperature. For this reason the water was determined by drying in vacuo over concentrated sulphuric acid, necessarily a rather slow process. Had the presence of wax been suspected I should have determined it in the same way. However when its presence was discovered there was only time for a hasty determination by drying in a water oven, so the figures for the wax are much too high. As this is in no way a food, acting probably as a preservative, it does not affect the analysis of the pollen as such. Dr. Phillips, Bee Expert for the Department of Agriculture, suggests that this wax may have come from carelessness in removing the pollen from the

cells. However, this very thing was carefully avoided, and although it is somewhat difficult to get the pollen without getting wax at the same time, I am certain that there could not have been enough obtained in that way to give the percentage resulting, even when corrected for the oxidation which occurred.

As one would naturally expect, there was a large amount of water in this substance, 12.75 per cent. being obtained. The bulk of the remainder is protein, 64.4 per cent., not too high when we remember that pollen is mainly protoplasm. 9.23 per cent. of fat were found. A peculiarity of this fat is worth noting. It appeared to be made up of several oils, some of which were extremely volatile and had a very penetrating disagreeable odor. Both cane sugar and sucrose were present, the total sugar content being 9.5 per cent. of which 1.3 per cent. was cane sugar, and 8.2 per cent. sucrose. The wax would probably give between three and five per cent if a more accurate determination were made.

	Per Cent.	
Water	12.75	(Would vary with conditions.)
Protein	64.4	(Probably constant to a fraction of a per cent.)
Fat	9.23	(Probably constant to a fraction of a per cent.)
Sugar	9.00	(Would vary with the amount and kind of honey.)
Wax	3 to 5	(Probably fairly constant.)

It would be interesting to analyze several pollens and compare them with the above composite pollens. In fact for a standardization of pollen such a scheme would be necessary. Yet since the amounts of the different substances that go to make up protoplasm do not vary greatly it is a question whether a series of analyses of the different pollens would differ to any great extent from the above analysis of the mixed pollen.

Syracuse University

TRAGOPOGON IN COLORADO

By T. D. A. Cockerell

Some years ago (1905) I noted that two species of *Tragopogon* were growing in Boulder, Colorado. Upon examination, they appeared to accord excellently with the two species credited to

our flora, *T. pratensis* L. and *T. porrifolius* L., and I accordingly paid no more attention to the matter. Later, I found a plant with intermediate characters, which was recorded as a hybrid between these species. This year I discovered that instead of two species, we had three; a second yellow-flowered form occurring in some abundance but quite locally on Tenth street. This caused me to collect a quantity of fresh material, which was described in detail. Having little European literature, I found it difficult to be sure of my species, and so sent particulars to Mr. Paul. C. Standley at the National Museum, requesting him to look in the European books. This he very kindly did, with the result of substantially confirming my guesses regarding the identity of the plants. *Tragopogon* as represented at Boulder may be described as follows:

TRAGOPOGON L.

Flowers purple; involucral bracts normally 8 to 10. *porrifolius* L.

Flowers very pale purplish; involucral bracts 9 to 13. *porrifolius* × *dubius*.

Flowers chrome yellow; involucral bracts 8; leaves twisted. *pratensis tortilis* Pritz.

Flowers lemon yellow; involucral bracts 13, rarely 8; leaves straight. . . . . *dubius* Scopoli.

Tragopogon porrifolius L.

Corolla purple; stigma purple; anthers black, ochreous marginal lines faint or absent; involucral bracts 8 or 10 in a head, 8 is the commoner number, one plant had heads with 8 and heads with 10; bracts entirely green, extending about 10 mm. beyond ends of lateral corollas; tips of pappus purple, subapical hairs pale brown; fruiting heads broad at base, the stem below strongly, not abruptly, swollen; foliage normal, leaves straight. Very abundant.

Tragopogon porrifolius × dubius hyb. nov.

Corolla very pale purplish; stigma pale grey; involucral bracts 9 or 13, extending about 9 mm. beyond lateral corollas; pappus

pale; foliage normal. Scattered plants, where *porrifolius* and *dubius* grow together. A plant I watched for seed proved entirely sterile.

Tragopogon dubius Scopoli

Corolla clear lemon yellow; stigma gray or blackish; anthers black, with ochreous marginal line; involucral bracts normally 13, but 8 in smaller plants; bracts entirely green, extending about 10 mm. beyond lateral corollas; tips of pappus and subapical hairs very pale brownish, not at all purple; fruiting heads not greatly broadened at base, but stem below greatly, but not at all abruptly, swollen; achenes very strongly tuberculate; foliage normal, the leaves straight. The heads are about 2½ inches broad when well developed. Abundant.

Mr. Standley, after seeing a head and my notes, wrote: "seems to be known in Europe as *Tragopogon pratensis minor* Fries. Probably this is the same as *dubius* Scop., at least so far as one can tell from the descriptions. Some authors cite the two as synonyms." My plant agrees very closely with the description of *T. dubius* in Wilczek and Schinz, Flore de la Suisse (1909), p. 629. The only discrepancy is in the number of bracts, which these authors give as 10 to 12.

Tragopogon pratensis tortilis Pritz*

Corolla chrome yellow (dandelion yellow); stigma clear pale orange; anthers black on outer side except at base, with ochreous marginal line; involucral bracts constantly 8; outer bracts with very conspicuous purple margins; bracts not extending beyond corollas; pappus colored as in *dubius;* fruiting heads very broad at base, but stem below little swollen; margins of leaves crinkled, wavy (but straight when flattened out), ends of leaves much curled, many of them corkscrew-like.

Mr. Standley says that this is *T. pratensis tortilis* Pritz, of which *T. undulatus* Reichenb. and *T. pratensis undulatus* Thuill. are synonyms. The Index Kewensis gives *T. tortilis* Pritz, Ic. Ind. ii, 275, and *T. undulatus* Thuill., Fl. Par. ed. II, 396 (not *undulatus* Jacq.); both as synonyms of *pratensis*.

*Since this was written I have (Aug. 1912) found *tortilis* in a garden at Santa Fé, N. Mex.

Later, Mrs. L. A. Moore brought me a number of heads from the other side of Boulder, which proved to be as follows:

(1) *T. dubius;* normal, but with 12 involucral bracts, going 10 mm. beyond corollas.

(2) *T. porrifolius;* normal, with 8 bracts.

(3) *T. porrifolius*, variety. Flowers pale lilac; 8 involucral bracts. Two specimens, in one the bracts going 5 mm. beyond flowers, in the other only as far as ends of corollas.

(4) *T. porrifolius*, variety. Flowers pale lilac as in 3, but rays very short, the total length of corollas of outer florets about 23 mm. The bracts, 10 in number, go about 17 mm. beyond corollas.

Are numbers 3 and 4 F_2 hybrids from *dubius* × *porrifolius ?* I cannot now find any typical *T. pratensis* in Boulder.

REVIEWS

Halls' Yosemite Flora*

Among the large number of books on out-of-door life we have seen none as attractive or as serviceable in make up as Professor and Mrs. Hall's "Yosemite Flora." The pigskin cover, the natural colored paper and the pocket size make it an almost irresistible companion to one interested in the wonderful flora display of Yosemite. Indeed the authors and their publishers have set a new standard which writers of popular books on natural history may well emulate.

Nor is the pleasing appearance the only virture of the new flora. A casual thumbing of the pages discloses several half-tone plates illustrating some of the floral attractions of the park and many well-drawn text figures that greatly enhance its value. An introductory chapter discusses in a very readable style the general floral features and life zones of the region. Another chapter gives clear concise directions to the novice in the use of the keys and explanations of the botanical terms.

From the preface we learn that nine hundred and forty-five

* Hall, Harvey Monroe, and Carlotta Case. A Yosemite Flora. Pp. vii+282. Paul Elder & Company, San Francisco. 1912. $2.00.

species and varieties are described, and that "the total number represented in the Yosemite National Park is considerably greater, since the grasses, sedges and rushes are here omitted." The omission of the grasses and related plants is probably justified since the book is planned primarily for the amateur and tourist, but without them botanists and foresters interested in the grazing problems of the Sierra Nevada will find the book seriously lacking.

Turning with a more critical eye to the text we find carefully worked out keys to the genera and species which will add much to the usefulness of the book. In the descriptive part emphasis is placed upon the species. The generic and family descriptions are brief, or when represented by a single species omitted entirely. In the conception of generic and specific lines the authors have been very conservative. They recognize, for instance, only one rose, which they term *Rosa californica;* as a matter of fact there are two roses in the region, neither of which, in our opinion, is typical *R. californica*. Again, *Castilleia parviflora* and *C. miniata* are included although students of the genus have long since recognized the Sierra Nevada plants as distinct from those northern species. Of course these are not serious defects, especially in a book planned for the amateur. The plant geographer, however, must needs be on his guard in using it for gathering data on plant distribution. But in many regards the "Yosemite Flora" is the best book that has appeared on the California flora since the "Botany of California." And although it nominally covers only a small section of the Sierra Nevada it will be found very useful throughout the mountain range.

L. R. Abrams

Gager's Review of Payne's Laboratory Manual of Experimental Botany.—A Reply

The review of Payne's Manual of Experimental Botany for high schools contributed by Dr. Gager in the June Torreya interested me considerably for two reasons: first because of my personal acquaintance with Mr. Payne, whom I know to be

a very successful teacher of high school botany, and second because I find in his text as published the method of approach which makes his work successful. It seems to me that in a review of the length of Dr. Gager's—three pages—the good points of Mr. Payne's book deserve more than a six line paragraph, and I hope in the following discussion to show reason for this opinion.

Dr. Gager's review begins with a criticism to which it seems to me strong objection may be raised in point of fact.

This relates to the general plan of the text in which Dr. Gager finds as one of the main weaknesses of the book "that botany is continually correlated with practical gardening, farming, and bacteriology." And further, to quote the reviewer, "Undoubtedly the movement to introduce the study of the principles of agriculture into secondary schools is a movement in the right direction, but why agricultural matter should be eternally mixed in with botany until the latter science loses all semblance of its real self, it is difficult to comprehend."

It appears to the writer that Dr. Gager's objections to correlating theoretical and practical plant study must have arisen from a misapprehension of the purpose of Mr. Payne in such correlation. One of the main difficulties in teaching elementary botany in high schools lies in finding an approach to the student which shall have interest for him, and ready connection with his previous knowledge. The experimental method of Mr. Payne's text-book is admirable for securing the pupil's interest, and the continual references to what may be spoken of as the applied phases of botany serve to clinch the facts in the pupil's mind as well as to explain the reasons for many common phenomena and their relation to plant life. And further the only facts about plants possessed by the ordinary city boy relate to their uses as food, drugs, lumber, clothing, etc. A country boy has additional knowledge of living plants and agricultural processes. Mr. Payne has endeavored to make useful this fund of knowledge by frequent references to the uses of plants and their culture in connection with the purely botanical study of the structure and function of typical plants. It is, of course, not to be expected

that all the exercises are as equally useful in the city as in the country, but they are in number sufficient to allow for the selection of an ample year's course in either situation.

There is another reason why a course designed to correlate theoretical and applied plant study is very timely. The majority of high school pupils who enroll do not finish half the high school course, much less enter college. The purely theoretical course in botany, along the lines laid down by the college entrance committee, has little more than a slight disciplinary value for the ordinary high school pupil. A high school course in botany which is designed mainly to prepare for college requirements is in the same class with the high school Latin work which is or used to be designed to prepare the student eventually to enjoy reading classical Roman literature in the mother tongue.

Botany for botany's sake is no longer an issue for the high school curriculum. Mr. Payne's text represents a step in the direction of a practical course for high school pupils. The value of the entire course as outlined can be determined only by actual use, but, it may be stated, much of it has already proved its value in first year high school work.

With respect to other criticisms which Dr. Gager has made which have to do mainly with details of accuracy and completeness, many of them are probably justified but even some of these are more or less excusable as inherent in the plan of the book.

The book consists almost entirely of exercises directing the pupil's observation and requiring some constructive thought on his part in carrying them out. The exercises cover, in the course of the book, the entire field of botany, the arrangement of matter being in general like that in most elementary texts. Scattered along in connection with the exercises are occasional brief notes which constitute the didactic matter of the book. The information given in these is such as could not possibly be learned by the inquiries of the pupil. The teacher is thus afforded full opportunity to lead the pupil to derive for himself the conclusions and generalizations proper to each exercise. The few definitions given are such as the pupil might be led to construct from the work done, and which he can entirely com-

prehend. They are thus liable to be somewhat incomplete and inaccurate, but the more complete and accurate definitions of most texts have the disadvantage of being only partly comprehensible as a result of class room work, the acquisition of the remainder being purely memory work.

Mr. Payne's book thus calls for a minimum of teaching by authority and a maximum of self-help by the pupil. In this method a much greater responsibility rests with the teacher but the results should more than compensate.

In conclusion brief reference may be made to another recent review of Mr. Payne's book (Bessey, C. E., Science II. **35**: 994. 1912). Prof. Bessey's main criticism is that the book follows too exclusively the single method of approach, the experimental. This fact finds its main defence, as noted above, in the purpose of the book to teach by the pupil's endeavor rather than by that of the teacher. The lack of expository matter certainly has some drawbacks but it seems to be a necessary defect of the virtues of the book. The ideal text will perhaps have the loose-leaf system, with experiments and expositions separate so that the pupil need not be given the latter until his work with the former is complete.

Another fault noted by Prof. Bessey has to do with the repletion of exercises, too many to be covered for a year's course, but he also finds much to commend in the form and matter of the exercises and suggests that teachers may with profit use the book as a source from which to draw experiments as needed.

It is to be hoped that Mr. Payne's book may receive the thorough working out to which, with its many merits, it would seem to be entitled. Defects it has without question, but these are mainly minutiae which can easily be rectified. The ultimate value of the plan and method can only be determined by the test of actual use.

R. C. Benedict

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New York City

NEWS ITEMS

The Rocky Mountain Herbarium has had collectors during the season in several of the western states. Professor Aven Nelson, accompanied by two of his students, J. Francis Macbride and Dorman Bennitt, spent the latter part of June and the early part of July in southwestern Idaho and northern Nevada. Through the courtesy of the Forest Service men connected with the Humboldt Forest, Mr. Macbride was enabled to remain in the field throughout the season, working various districts in that forest. The collections from these two states are in duplicate and will be worked up as rapidly as circumstances will permit.

Mr. Ernest P. Walker, another student of the University of Wyoming, has been collecting since late June, in southwestern Colorado, in Paradox Valley. He has extended his observations into the adjacent mountains of Utah. These collections are also in duplicate, and, it is hoped, will be available before the end of the school year.

Dr. H. W. Anderson has been appointed Rose professor of botany at Wabash College, and Professor J. S. Caldwell, of the University of Nashville, has accepted the professorship of botany in the Alabama Polytechnic Institute, Auburn, Alabama.

R. Heber Howe, Jr., of the Thoreau Museum, has received the degree of Docteur de l'Universite from the Sorbonne for research carried on at that university during 1911–12. His thesis was on the "Classification de la Famille des Usneaceae dans l'Amerique du Nord."

The following appointments are announced at New Brunswick, N. J.: Mr. J. P. Helyar, seed analyst of N. J. Agricultural Experiment Station and instructor in botany at Rutgers College; Mr. C. A. Schwarze, assistant state plant pathologist, N. J. State Board of Agriculture; Mr. G. W. Martin, assistant plant pathologist for the experiment station; and Miss Marion G. Pleasants, laboratory assistant in the botanical laboratory of the experiment station.

Miss Jean Broadhurst, of Teachers College, Columbia Uni-

versity, has a year's leave of absence and is spending the time at Cornell University studying plant physiology and bacteriology.

Professor Hugo de Vries planted a tree and delivered a lecture for the Brooklyn Botanic Garden on September 14. On September 16 he lectured on "Experiments in Mutation" at the New York Botanical Garden. In the evening a dinner was given to 26 botanists in honor of Professor de Vries by Professor R. A. Harper, of Columbia University.

Professor Geo. R. Lyman will spend a year's leave of absence from Dartmouth College as lecturer on botany at Harvard University, carrying the work of Professor Roland Thaxter, who is to visit Trinidad and neighboring islands.

Professor Charles A. Shull, for the past five years in charge of biology in Transylvania University, Lexington, Ky., has been appointed assistant professor in the botany department of the University of Kansas, where he will give the courses in plant physiology and genetics.

Extensive changes are being made in the biological department at DePauw University, Greencastle, Ind., that will give increased capacity for the work of the department. The lecture room will be more than doubled in size and the laboratories will be far better lighted than formerly.

Mr. T. W. Moseley, assistant in agricultural botany in the University of Nebraska has returned from the University of Chicago, where he was taking work in plant physiology during the summer.

Mr. F. E. Miller, of the University of Missouri, was appointed assistant horticulturist at the Virginia Truck Experiment Station and entered upon his duties September 1, 1912.

Mr. Ray E. Torrey, recently an assistant in the department of botany at the Massachusetts Agricultural College, will teach biology at Grove City College this year.

On July 16 Dr. George H. Shull, of the Station for Experimental Evolution, lectured at the Marine Biological Laboratory, Woods Hole, Massachusetts, on "The bearing of cross and self fertili-

zation in heredity and evolution." He also took occasion on the same trip to visit the Bussey Institute of Harvard University.

Professor J. J. Thornber, botanist to the University and Experiment Station of Arizona has just returned to his work after a twelve months leave of absence. Professor Thornber has spent the past year at the Smithsonian Institution in Washington, D. C., where he has been engaged in writing a manual of the flora of Arizona.

Mr. J. S. Cooley, assistant in plant pathology in the Virginia Experiment Station, will occupy a fellowship at the Missouri Botanical Garden during the coming academic year.

A botanic garden of one and a half acres is being developed at Grinnell College, Iowa, under the direction of Professor Henry S. Conard. It is primarily a teaching garden, and now contains about 300 species and varieties of herbs and shrubs.

Miss Elena R. Prats, who recently graduated from Columbia University, has accepted a position as instructor in biology in the College of Agriculture and Mechanic Arts of the University of Porto Rico.

Professor Thomas H. Macbride, professor and head of the department of botany, State University of Iowa, has been granted leave of absence for the year 1912–13, and is spending the year in botanical exploration in the western states. The latter part of the summer was spent in a mycological survey of the region near the snow line of Mt. Ranier with special reference to the Myxomycetes of that locality.

Mrs. Blanche Trask, of Los Angeles, California, who has brought to light many interesting facts about the peculiar flora of Santa Catalina Island, is recovering from a long illness, and is shortly to return to Santa Catalina to pursue further field studies.

Mr. F. Tracy Hubbard, of the Gray Herbarium, spent the summer in the study of the Gramineae at the grass herbarium of the United States Department of Agriculture and in field work in Maryland and Virginia.

Professor A. S. Hitchcock, systematic agrostologist of the

United States Department of Agriculture, has gone to the West Indies for the purpose of studying and collecting grasses. He is accompanied by his son, Albert E. Hitchcock, as assistant. They will go first to Jamaica and later to various points in the Windward Islands, probably visiting last the island of Trinidad.

Dr. F. D. Heald, until recently professor of botany at the University of Texas, has moved to the University of Pennsylvania to accept the position of pathologist of the Chestnut Tree Blight Commission.

Professor Guy West Wilson, of the North Carolina Agricultural Experiment Station, was awarded a research scholarship at the New York Botanical Garden for the month of September to aid him in his researches on parasitic fungi. Mr. Wilson will continue his work during the year as a graduate student of Columbia University.

We learn from *Science* that the late Mr. Allan Octavian Hume, known as an ornithologist and botanist, bequeathed about £14,000 to the South London Botanical Institute, to which in 1907 he gave £10,000.

The botanical work at the University of North Dakota is being extended this year under the direction of Dr. Melvin A. Brannon. Miss Norma Pfeiffer, of the University of Chicago, and Miss Mabel Olson have been made assistants. A teaching and experimental greenhouse is being constructed and a liberal addition is being made to the equipment of the physiological laboratory.

Dr. Vladimir Doubiansky, conservator of the Imperial botanical gardens at St. Petersburg, who is now travelling with the geographers, spent a day at the University of Washington, looking over the botanical equipment at that institution.

Dr. Edith M. Twiss, assistant professor of botany and dean of women in Washburn College, has been promoted to the position of professor of botany.

Dr. and Mrs. N. L. Britton have returned from the island of Bermuda, where they have been spending a month with Mr.

Stewardson Brown, of the Academy of Natural Sciences, Philadelphia.

Professor A. F. Blakslee has a year's leave of absence from the Connecticut Agricultural College. He has a temporary appointment on the staff of the Carnegie Station for Experimental Evolution at Cold Spring Harbor, L. I., N. Y., where he will spend the year in research work on the lower fungi.

Dr. Ira D. Cardiff, professor of botany in Washburn College, has been appointed professor of plant physiology and plant physiologist of the Experiment Station of the Washington State College at Pullman.

TORREYA

November, 1912.

Vol. 12 No. 11

THE RELATION OF SNOW COVER TO WINTER KILLING IN CHAMAEDAPHNE CALYCULATA*

By Frank C. Gates

During the course of a piece of investigation at the University of Michigan during 1910–1912, some interesting observations and measurements were made upon *Chamaedaphne calyculata*, a heath plant which grows in the peat bogs of the vicinity.

The winter of 1910–11 was normal for southern Michigan. No extremely low temperatures were recorded and the snow, although above the average during the early part of the winter, was below it during the coldest weather, so that at the time of severest cold (– 20° C.) the bushes of *Chamaedaphne* were less than half protected. The cold spells were of short duration, however.

The winter of 1911–12 was extreme both in amount and duration of cold and of snow. New records were set both for the absolute minimum and for the duration of severe cold.

Before entering into the main subject a brief account of the vegetational history of *Chamaedaphne* will be advantageous. During the early part of a growing season the shoots of the year develop large (2–4 cm. long) leaves. Towards the end of the growing period small leaves, in whose axils are flower buds, are produced. Both large and small leaves remain on the bush over winter. With approaching winter the green color of the leaves is replaced by a dark reddish brown, the petioles become red, and the leaves bend up into an upright position. With the

* Contribution from the Botanical Laboratories of the University of Michigan, No. 135. Spelling changed from the form recommended by the Simplified Spelling Board, to conform to the usual procedure in Torreya.—Ed.

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advent of spring the leaves gradually regain their green color and their summer position. The flowers appear early in spring, and later the shoots of the year appear from nodes back of the inflorescence. As these shoots develop the older leaves gradually die and drop off.

FIG. 1. General view in the Mud Lake Bog at the time of deepest snow, showing the *Chamaedaphne* covered with snow except where exposed by brushing away the snow from a path. Spruce and tamarack in the background. March 16, 1912.

At the time of blooming in 1911, during the latter part of April, the bushes were green clear to the tops and flowering was profuse. Although dead leaves and flower buds could be found here and there, their presence did not affect the general appearance of green vegetation.

The spring of 1912 was radically different. Blooming was later, occurring in the first week of May and, although rather profuse, the general impression was one of dead brown leaves and dead flower branches. Only by looking very carefully or better by walking among the bushes could one really realize that the plants were in bloom and that the old leaves had greened-out.

A most striking feature however was the remarkable transition between flowers in bloom, and greened-out leaves and dead leaves and buds, which occurred about two thirds to three fourths of the height of the bushes from the ground. It was noticeably higher in the centers of large bushes and in wind-protected areas and lower in wind-swept and less protected areas. It corresponded remarkably to the general level of the snow which partly covered the bushes during the severe and unusually prolonged cold weather of February, 1912.

FIG. 2 A view in the Mud Lake Bog at the time of flowering, showing the dead buds at the tops of the bushes. The snow level was about 70 cm. May 9, 1912.

Observations had been made nearly every week all winter and before the severest cold weather the snow was 50 to 66 cm. (20–26 inches) deep in the *Chamaedaphne* association, varying according to the exposure to wind. All during the very cold weather the depth of snow at First Sister Lake, west of Ann Arbor, Michigan, was more than 20 inches and in places reached heights of 75 to 90 cm. (30–35 inches) on the general level of drift.

At Mud Lake, north of Ann Arbor, where *Chamaedaphne* occurs in the openings in the spruce and tamarack, the snow was regularly deeper, a general level being 80 to 90 cm. (31–36 inches) and up to 110 cm. (43 inches). In wind-sweeps the snow level during the very cold weather was about 50 cm.

In order to express the results other than through general impression by eye, in May, 1912, the per cent of dead flower buds out of the total number of buds produced in the spring of

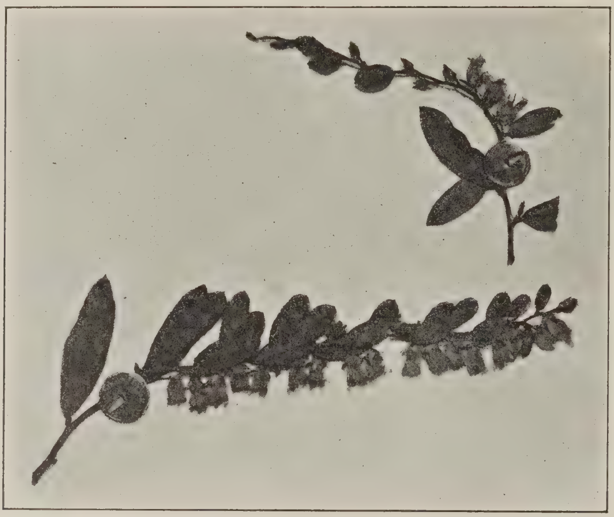

FIG. 3. Twigs of *Chamaedaphne*, in the upper the outer end killed. (From material collected at Mud Lake, May 9, 1912.)

1911 was ascertained for different levels above the ground. Strips 20 cm. wide running from the outside of the bush to the center were selected and the total number of blossoms and dead buds were counted in 10 cm. intervals from the ground to the top of the bush and the results tabulated.

In every case where bushes had been entirely covered with snow, the per cent of blossoms was 98–100 per cent of possibility. Where the bush was only partly covered, at the snow level, there was an abrupt change in the per cent of blossoms from about 80 per cent and higher to less than 30 per cent and to zero in the tops of the higher bushes. When flowering occurred at all

above the snow line it was only the basal two or three buds, while a flowering shoot normally contains about a dozen flowers (6 to 19).

One might say that it was natural for the outer parts of the *Chamaedaphne* to die back each year, but it was repeatedly observed both at First Sister Lake and at Mud Lake that long bent over stems (sometimes 2 meters in length) which remained below the snow line were profusely flowered, while short stems (sometimes as short as 15 cm.) on hummocks in the center of clumps, which projected the greater part of their length above the snow, were uniformly killed back.

Killing was probably due to too thorough drying out of the exposed parts and not to freezing. It may be doubtful whether actual freezing had taken place as the leaves and twigs, while attached to the bushes, remained pliable in the lowest temperatures tested ($-24°$ C.), whereas the same twigs soon became brittle when severed from the plant.

TABLE SHOWING THE RELATION OF SNOW LEVEL TO WINTER KILLING IN *Chamaedaphne calyculata* (L.) MOENCH

(The first two examples are taken from data obtained at First Sister Lake and the others from Mud Lake bog. The first column under each example is the total number of flowers buds produced in 1911, while the second column is the per cent. which were killed during the winter of 1911–12. Numbers in italics are based upon parts of the plants above the snow level.)

Cm.	I		II		III		IV		V		VI		VII	
	Snow 56 cm.		Snow 65 cm.		Snow 85 cm.		Snow 85 cm.		Wind sweep snow 55 cm.		Snow 80 cm.		Snow 72 cm.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
90–100			*18*	*100*			*32*	*100*						
80– 90	*80*	*99*	*149*	*98*	34	0	*61*	*71*						
70– 80	*466*	*92*	*108*	*57*	97	0	96	0	*8*	*100*	182	0	*10*	*100*
60– 70	*317*	*80*	*100*	*50*	92	0	72	0	*122*	*98*	31	0	115	3
50– 60	161	27	115	17	—		9	0	*54*	*59*	—		124	0
40– 50	168	17	74	0	—		—		61	5	—		85	0
30– 40	212	2	130	3	—		—		—		—		55	0
20– 30	—		—		—		—		—		—		18	0
0– 20	—		—		—		—		—		—		—	

The natural distribution of *Chamaedaphne* is northern and throughout its range it is usually efficiently protected from the drying effect of severe prolonged cold by a covering of snow.

Recurring, severe, prolonged cold weather will kill it down to the snow level and the occurrence of such cold without an adequate snow protection must be at least one of the important limitations to the distribution of this plant in places which would otherwise be suitable for it.

University of Michigan

SHORTER NOTES

Shade-induced Uprightness in the Seaside Spurge.—For some years my attention has been drawn to the behavior of *Euphorbia polygonifolia* L. as it grows in abundance upon the sand along the New Jersey coast. When growing in the open, the plants lie flat upon the sand and form attractive patches, the closely-forked stems varying in color from a pale green in some individuals to that of a bright red in others.

However when the plants chance to be among any shore grass the aspect is so changed that one might pass them by as of another species. Instead of the thick-set, stout, many-jointed plant it assumes an upright position and the internodes are several inches in length. Such plants do not thrive in even the partial shade of the slender-leaved grass and probably rarely set seed.

By subjecting very young plants, started in the full sun, to the shade of twigs stuck into the sand near them the writer has been able to note the taking on of the upright habit. When the plants have already become prostrate the artificial shade brought to them will induce a turning upward of the tips of the stems.

Many kinds of prostrate plants exhibit this tendency to become erect in the shade, but none seem to be more sensitive than the spurge in question. Byron D. Halsted

Ancient and Modern Views Regarding the Relation of Taxonomy to Other Phases of Botanical Work.—In the April number of Torreya, Dr. P. A. Rydberg in his article on "Phytogeography and its Relation to Taxonomy and Other Branches of Science" says a few words in defense of taxonomic

work, as follows: "Not long ago all botanical work done in this country was taxonomic work, usually known as systematic botany, although much had indeed little of 'systematic' in it. Now it is different. Courses in taxonomy are almost excluded from the curriculum of many of our colleges and universities or if not excluded so little esteemed that students are discouraged from entering upon them. *The taxonomist whether a systematic botanist in the true sense or a phytographer, is looked upon by phytogeographers, ecologists, physiologists, cytologists, and morphologists as of a lower grade of stuff;—as if it took a less fine grain of brain to make a first class systematist than any other kind of -ist.*"

It might be of interest to taxonomists as well as to those who are inclined to look upon physiology or morphology as representing the modern idea of what botany is or ought to be, while those whom they choose to call "mere taxonomists" are relegated to the same category as "stamp collectors," to compare recent views as expressed by Dr. Rydberg with those of one of the leading English mycologists who worked more than half a century ago.

In a paper read before the Quekett Microscopical Club on February 23, 1877, Dr. M. C. Cooke gave expression to his views in the following words: "In all branches of Natural History there are workers of two kinds: those who investigate the structure, physiology, origin, and development of a few forms, and endeavour to comprehend the whole mystery of their existence, and relationship to other manifestations of vital force, and those who devote themselves almost entirely to the study of various forms in any one or more groups, their relationship to each other, and their systematic and orderly arrangement, their affinities and their differences and their geographical distribution. *It is not uncommon to find those of the first group, the biologists, or physiologists, claiming a higher position for themselves than they accord to students of the other class, and even sneering at them as mere species-makers, or compilers of catalogues.* This is not only unjust but untrue; both are equally useful and equally essential and should not be made the subject of comparison. The work of the former is a great help to the latter whilst without classification there could be no science."

From the above quotations it will be seen that the ideas of those who are inclined to draw unjust comparisons between "mere taxonomy" and other phases of botanical work are not modern; neither are they restricted to this country but were current in England fifty years ago.

F. J. SEAVER

REVIEWS

Pammel's Manual of Poisonous Plants*

A Manual of Poisonous Plants is the title of a book recently pubished by L. H. Pammel, in which the author brings together into one volume most of the literature pertaining to plants injurious to man and to live stock.

The astonishing size of the book is explained on the first page of the foreword, thus: "I have placed the broadest interpretation on the subject and have, therefore, included all plants that are injurious, although many of these are not known to produce poisons, some even being most useful economic plants, and yet injurious to some people." Later on Pammel also says: "During the last decade, there has been much interest manifested in regard to plants injurious to live stock." I quote this as showing not only the trend of the author's thought, but to account, in part, for the great size of the volume.

The first chapter is headed "Poisons and Statistics on Poisons" and contains such sub-headings as "Ancient Use of Poisons," "The Rise of Chemistry and Poisons," "Ratzenburg on Poisonous Plants," "Statistics on Poisoning," "Statutes on Poisoning" and "Actions of Poisons on Different Animals." Under "Statistics of Poisoning" is given the number of persons dying by taking active poisons and by inhaling illuminating gas, and the poisonous cases reported among live stock in Montana during 1900. There are only seven pages in this chapter and the different subjects are treated so briefly that the information is necessarily very meagre.

* Pammel, L. H. Manual of Poisonous Plants. Pp. 1–977. f. 1–458 + many unnumbered figures and plates. The Torch Press, Cedar Rapids, Iowa. 1911. $7.00.

In the second chapter, under "Bacterial Poisons" impure water is considered as a source of disease, citing cases of poisoning among cattle resulting from drinking polluted water. Other subjects considered are botulism,—poisoning resulting from the action of *Bacillus botulinus*, which occurs in spoiled ham and sausage. Ptomaine poisoning is briefly considered, followed by a discussion of madismus,—poisoning resulting from eating spoiled Indian corn.

Chapters III, IV, VI, VII, VIII and IX are, except in a few instances, a treatise on veterinary practice. In these chapters appear such headings as "Dermatocytosis," explaining the causes, symptoms and treatment of skin diseases in the lower animals, considering among others, the ring worm of the horse in great detail, "Forage Poisoning," "Equisetosis," "Locoism," "Lupinosis," "Delphinosis," "Aconitism" and "Veratrism." The symptoms of poisoning as they occur in the live stock, together with the methods of treatment, are usually given in minute detail, which information is, of course, very valuable to the veterinarian, in diagnosing and treating cases of poisoning.

Chapter V, "Poisoning from Fungi," is mostly a discussion of reported cases of poisoning. The author states that it has been reported that a given fungus is sometimes eaten with impunity, while at other times it proves fatal. The author doubts if the same species were eaten in both cases, and that it would be impossible for a fungus to be poisonous at one time and not at another. Professor Peck, I believe this year, demonstrated that a fungus may develop poisonous properties when grown in one locality and when grown in another section of the country be edible and harmless.

In Chapter X, under "Poisoning from Flowers," reference is made to *Prunus serotina*, *Stapelia*, *Smilax herbacea*, *Polyanthes tuberosa*. On page 64, the author states that "The flowers of *Magnolia grandiflora* are overpowering, according to some authorities." Odors undoubtedly affect people differently; an odor which is disagreeable to one person may be pleasing to another. Asafoetida, which is displeasing to most people, becomes very pleasing on repeated handling. Asafoetida is used

among our southern negroes, not for its medicinal value, but for its odor and the belief that if carried about the person, it will ward off illness and bring good luck.

Under the sub-heading "Poisoning from Honey," it is stated that *Kalmia latifolia*, *Robinia pseud-acacia*, *Euphorbia marginata*, and species of rhododendron have been proved as sources of poisonous honey. The above facts should prove of value to bee keepers. The source of the honey of the market is not known except in a general way as clover, buckwheat, etc. A microscopic examination of honey will often reveal its source through the presence of characteristic pollen-grains.

The eleventh chapter is pure toxicology, giving a classification of poisons with symptoms and antidotes.

In Chapter XII, under "Distribution of Poisonous Substances in Plants," Dr. Pammel speaks of some of the conditions governing the formation (elaboration) of poisonous substances, *i. e.*, light, heat, seasons, climate and cultural conditions. The time (season) of collecting medicinal plants is of first importance. This time varies with different drugs. The reviewer usually groups the plant parts for purposes of collection as follows: tubercules, tubers, bulbs, rhizomes, and roots should be collected at the close of the growing season; barks in the fall, after the death of the foliage, or before the spring foliage is fully developed; flowers, just before expanding; leaves and herbs, just at the beginning of the flowering period and most of the fruits when immature, but full-grown, and the seeds when mature. Under "Culture" it is stated that cultivation often entirely eliminates the poisonous constituent. *Lyanthus*, *Phaseolus lunatus* and *Aconitium napellus* are cited as becoming less toxic under cultivation. This latter statement would seem to be disproved by the fact that the British Pharmacopoeia requires British pharmacists to use only cultivated aconite grown in England. Also much of the golden-seal of the market is collected from cultivated plants. Analyses show the alkaloid in cultivated golden-seal to be present in even greater amounts than in the wild variety. This shows that no definite law can be given. One of the most important factors in increasing the percentage of active con-

stituents in plants and a fact which is not mentioned, is in annually selecting for seed purposes, plants yielding the highest percentage of active constituents.

The thirteenth chapter deals with the algae in fresh-water supplies, specially with the working of the lakes and water bloom caused by various species of algae, chief among which are *Beggiatoa*, *Anabena*, *Lymbya* and *Clathrocystis*. The first remedy suggested for preventing these growths in reservoirs is to cover the reservoir. This, of course, is impracticable and would result in more harm than good if it were possible of application. The use of copper sulphate as an algicide is then considered.

Chapter XIV catalogues the more important poisonous plants of the United States and Canada. The material in this chapter is elaborated on and forms the basis of the second part. This part, consisting of 827 pages, includes all groups of plants from the bacteria to the flowering plants. In the beginning there is a key to the plant kingdom which is purely descriptive. This description is elaborated under each order. The plants considered poisonous are placed after the family; their description and habitat is given, and detailed descriptions of symptoms of poisoned animals and treatment as in Part I are frequently included.

This part is very broad in scope and names plants which are in daily use as staple articles of food, as rye, oats, wheat, and corn. These are mentioned as poisonous for the reason that when they are attacked by fungi they are injurious. The attack of the fungi completely changes the nature of their constituents and their structure, as is well illustrated by ergot. Ergot is no longer rye, but the resting stage of *Claviceps purpurea*. Such well-known fruits as pears, apples and peaches are classed as poisonous, as the seeds contain hydrocyanic acid and benz-aldehyde. The seeds and kernels are not the portion of these fruits which are eaten, but you can eat a limited amount of these parts with impunity. Yeast is considered poisonous on account of the alcohol produced by the action of its enzymes on sugar in solution. The alcohol is poisonous, not the yeast plant. Raspberries and blackberries are classed as poisonous, as there are several reported

accidents due to mechanical injuries. According to this logic, needles, knives and forks would be classed as poisonous in a list of poisonous metals. Then too, such common plants as dandelion, chickory and marsh marigold are cited, in spite of the fact that these plants form part of the diet of thousands of people. No one under normal conditions could be forced to eat sufficient burdock root, *hydrastis* or *berberis* to prove fatal. There are hundreds of plants listed in these pages which are practically harmless in their normal form, yet when altered, as when their active constituents are extracted, and when administered in concentrated form, may prove injurious, if not poisonous. These plants should not be classed as poisonous, however, merely because in their changed form they are harmful in excessive amounts. Most of these and similar plants should be, and usually are classed as medicinal. It is doubtless true that all the poisonous plants are medicinal, yet only a small percentage of the medicinal plants are poisonous, in the generally accepted sense of the term. A clear line should be drawn between the mechanical-toxic and the medicinal-non-toxic plants. I suppose there is scarcely a food plant which some time or other has not been reported injurious or harmful to some one. This, however, should not be the test as to whether a plant is poisonous or non-poisonous. This ground is untenable and has resulted in the inclusion of hundreds of plants in the present volumes which are universally conceded to be non-poisonous. It is the author's elastic use of the word poison which is to me the weak point of the book. The volume is concluded with a catalogue of the plants of the world, poisonous or injurious to man. This list, like the manual, contains hundreds of economic and relatively harmless plants.

The author has brought together in these two parts the results of experimentation and research carried on under the direction of the United States Department of Agriculture at various experiment stations, as well as portions of the work of such men as Nelson, Peters and Bessey. This in itself would make the volume valuable, but added to this is the knowledge and fertile experience of the author who has for many years been one of the chief exponents of this line of work.

Part Two is really a manual of economic, medicinal, and poisonous plants, the poisonous plants being treated from the toxicological and veterinary standpoints chiefly. While the book contains a fund of information valuable to the physician, botanist, and layman, its greatest usefulness will doubtless be to students of animal industry and in particular to the veterinary practitioner.

The great number of illustrations and half-tone plates add to the value of the book. The paper is good. The subject matter is nicely spaced and arranged, and printed in good readable type.

William Mansfield

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Scharff's Distribution and Origin of Life in America *

This is an octavo book of 497 pages, including 32 of bibliography and 26 of index, both of which important features are comprehensive and well arranged for quick and easy reference. The illustrations, twenty-one in number, are maps, which are in part designed to indicate the theoretical land and water conditions in certain periods of Mesozoic and Neozoic time, and in part to show the known distribution, past and present, of certain specific and family types of animal life in America.

As a compendium of recognized facts in paleogeography and the distribution of the faunal elements discussed the work is useful and valuable; but in certain other respects it may better be designated merely as "interesting," especially in connection with some of the theories advanced by the author to account for some of the facts discussed, and the more or less *ex parte* manner in which authorities are cited and quoted in support of the author's views and contentions. In fact those who are not well acquainted with the literature of the subject might infer, from the text, that certain theories not generally accepted had a preponderating weight of authority in their favor.

In fairness to the author, however, it should be said that he is quite frank in disclaiming an unprejudiced attitude in relation

* Scharff, R. S. Distribution and Origin of Life in America. Pp. i–xvi + 1–497, f. 1–21. New York, The Macmillan Company, 1912. *Price $3.00.*

to certain matters which he wishes to prove, and hence cites and quotes from those who favor his views more extensively and freely than from those who are opposed. For example, he says, in connection with the glaciers of the Ice Age: "To attempt even to discuss all the various lines of evidence which have led to the almost general acceptance of the land-ice theory, as understood at the present day, would be impossible in a work of this nature. I only wish to bring forward some of the chief reasons which have prevailed upon me to reject this theory." Conservative geologists might also regard some of his theories as more or less superfluous or unnecessary as, for instance, when he proposes to account for the well recognized marine or brackish-water conditions in the Great Lakes region during Pleistocene time in the following words: "Supposing the waters of the Arctic Ocean had risen, perhaps in consequence of the closing of the Atlantic Ocean, and had poured into Hudson Bay, overflowing its banks, and had then crossed the low-lying watershed separating this region from the depressions of the Great Lakes, the latter would soon have filled with brackish water. . . . I presume, of course, that troughs, not necessarily like the lakes now existing, already occupied the same region in pre-Glacial times." And then the generally accepted theory, based upon observed facts, is dismissed in the following summary manner: "Such an hypothesis of this area having been invaded by the sea in Pleistocene times is supported by some biological evidence, though it is usually argued that the ocean crept inland through the St. Lawrence and Hudson River Valley."

The geological discussions in general, especially such as relate to assumed former physiographic conditions and continental land connections, are reasonably complete, even including an argument for the former existence of a second "Atlantis," in the form of a land bridge in the Tertiary period, in order to account for certain phenomena of modern faunal distribution in the West Indian and Mediterranean regions.

Several excellent lines of argument are narrowly missed by the author in connection with his remarks on climatic conditions and unglaciated areas during the Glacial epoch, but his arguments

are often either poorly expressed or are inconclusive as, for example: "No special reason can be deduced, therefore, why the present flora of Greenland should not have survived the Ice Age in that country, particularly as we have some grounds for the belief that the land in parts of the Arctic Regions then stood higher than it does now, and that consequently more land was available for plant life."

By careful reading of the entire work the botanist will find a few pages and some stray paragraphs here and there relating to the floras of Greenland, Alaska, the pine-barrens of the eastern United States, Florida, Bermuda, the Galapagos Islands, Central America, and South America; but the entire presentation and discussion of the facts relating to the botany and paleobotany of the latter continent occupies only four pages, and the other regions mentioned receive even less attention, relatively as well as actually, so far as the importance of their floral elements are concerned. If it is conceded that the title of a book should be truly indicative of its contents, this one should be changed to "Distribution and Origin of the American Fauna with Incidental References to the Flora."

Arthur Hollick

NEWS ITEMS

During the past summer Mr. W. W. Eggleston spent May and June collecting between Greycliff and Livingston, Montana, July and early August in Sevier Forest, southern Utah, and the remainder of the summer about the head of Lake Peud d'Oreillo, Idaho. Mr. Eggleston returned to Washington the latter part of September.

On October 14 Dr. Oliver A. Farwell delivered a lecture before the Scientific Institute of Detroit on the "Application of Botany to Pharmacy."

Mr. F. W. Pennell, of the University of Pennsylvania, has been traveling through the southeastern states this autumn collecting *Gerardia* and related genera.

Prof. Hugo de Vries spent two days at Tuscaloosa, Alabama, on his way to the type station of *Oenothera grandiflora*. At Mobile, Prof. de Vries met Prof. Tracy and they went 100 miles up the Alabama River to the station of the evening primrose. Mr. H. H. Bartlett accompanied Prof. de Vries while the trip led through Alabama. Early in October Prof. de Vries left with Prof. Tracy for Mississippi, Louisiana and Texas.

Dr. R. C. Benedict has been appointed an assistant teacher in the department of biology at the High School of Commerce, City of New York. The appointment took effect October first.

To the list of institutions, quoted on page 173 of TORREYA, as possessing the Flora brasiliensis should be added the Peabody Library and the library of Captain John Donnell Smith, both at Baltimore. The latter was given to the Smithsonian Institution some time ago, but has not yet been moved.

Professor Thomas H. Macbride, head of the department of botany in the State University of Iowa, is on leave of absence for the present year. He has been spending some time at Olga, Washington, on Orcas Island, one of the San Juan group. He and his family will live in Seattle until March or April.

Dr. Hally M. D. Jolivette, formerly instructor in botany in Leland Stanford University, has been appointed instructor in botany in the State College of Washington.

Professor R. Kent Beattie, formerly head of the department of botany in the State College of Washington, has resigned to accept a position in the Division of Plant Pathology, Bureau of Plant Industry.

Dr. W. J. G. Land, of the University of Chicago, sailed from San Francisco on Aug. 27, for Samoa, where he will collect liverworts and mosses. He will also visit the Sandwich Islands, Fiji Islands, New Zealand and Australia.

Mr. W. F. Wight, of the United States Department of Agriculture, who has recently spent four months studying plants in European herbaria sailed from London on August 16, for Argentine Republic where he will spend six months organizing a Division of Seed and Plant Introduction under the Argentine

Office of Experiment Stations. Mr. Henry F. Schultz, formerly of the United States Office of Seed and Plant Introduction, will have charge of sub-tropical introductions. Mr. James H. Cameron, formerly of the National Botanical Garden, will have charge of the propagating garden.

Dr. W. D. Hoyt has retired from his position at Rutgers College and will take up work at the Johns Hopkins University. He will spend the year principally in working on his report on the marine algae of Beaufort, N. C., for the United States Bureau of Fisheries.

Professor J. C. Arthur and Dr. Frank D. Kern spent a month during the past summer in field work in Colorado in continuation of their investigations of the Uredinales. The time was chiefly spent in the southern and southwestern portions of the state in localities not visited by them on previous trips.

Dr. J. N. Rose and Wm. R. Fitch spent about three weeks of September in southwestern Kansas studying especially the Cactaceae of that region. They also collected about 160 numbers of plants in that general locality.

Mr. Charles W. Finley, who for three years has been assistant in natural science in the School of Education, University of Chicago, has been appointed head of the department of biology of the State Normal School at Macomb, Illinois.

Dr. George B. Rigg, instructor in botany in the University of Washington, is engaged in work on the kelps of the Puget Sound region under an appointment from the United States Bureau of Soils. The investigation concerns the economic utilization of these kelps with special reference to their use as a source of potash fertilizer.

Dr. Roland M. Harper, of the Alabama Geological Survey, who spent the summer at the Biological Station of the University of Michigan at Douglass Lake, returned home through Illinois, visiting friends at the University of Chicago and the University of Illinois.

On the anniversary of Founders Day at McGill University, October 8, the university lecture was delivered by Francis E.

Lloyd, recently appointed MacDonald Professor of Botany. His subject was "The Artificial Ripening of Bitter Fruits."

The teaching staff of the Department of Botany at Syracuse University has been increased by the addition of Instructor Henry F. A. Meier, B.A. (Indiana University). Mr. Meier has had extended experience in teaching botany in the high schools of Indiana and was Sec.-Treas. of the Indiana Science Teachers' Association. The elementary course in Botany at Syracuse this fall has 225 students, the second year, 60 students.

Mr. A. J. Pieters, who has spent the past year studying the biology of water plants at Heidelberg, has been appointed instructor in botany at the University of Michigan.

Mr. F. C. Gates is in Manila at the University of the Philippines at Los Baños. He is teaching and doing research work for the United States Department of Agriculture.

Dr. Harry B. Humphrey, for three years professor of plant pathology in the State College of Washington, has been advanced to the position of head of the Department of Botany.

We learn from the *Evening Post* (26 October) that the corporation of Yale University has appointed Hugo de Vries as one of the Woodward lecturers for 1912–13.

An important acquisition to the collections of the Brooklyn Botanic Garden has just been negotiated whereby it will receive living specimens of more than 400 species of woody plants of the E. H. Wilson collections from China. These were secured during four expeditions to the republic and comprise the most important collections of living plants ever brought from that country. The Arnold Arboretum by whom the expeditions were conducted retains the most complete set. Other collections of a more general nature have also been received from the Arboretum and from the Park Commission at Rochester, N. Y., where the public park system is perhaps the richest, botanically, in America.

On the afternoon of Wednesday, October 31, in the presence of Park Commissioner Stover, Dr. N. L. Britton and a large gathering of spectators, the "oldest and biggest tree in Manhattan" was dedicated. The specimen is a giant tulip tree

situated on the estate of the late Ernest Thalman, at Inwood, the extreme northerly end of Manhattan. Speeches were made by Commissioner Stover, Gen. James Grant Wilson, Dr. Stephen Smith, R. P. Bolton and Dr. Britton, who spoke in part as follows: "The tulip tree is the most characteristic tree of eastern North America. It grows naturally from Rhode Island, southern Vermont and Michigan on the north to Florida, Mississippi and Arkansas on the south, preferring rich, loose soil and the society of other trees. Its greatest size is attained in Tennessee and Kentucky, where it sometimes reaches nearly 200 feet in height, with a trunk diameter of nine or ten feet. The noble individual whose preservation we meet to-day to celebrate is probably the largest trunk in diameter known in this part of the country. Its circumference of nineteen feet indicates a diameter of a little more than six feet. There are, however, not a few specimens in upper Manhattan and the Bronx with trunks approximating five feet in diameter. The roots of these great trees are very long and numerous, extending in the soil far from the base.

"The tulip tree leaves are very different from those of any other plant; its large greenish yellow flowers open in May or June, and a fancied resemblance to those of tulips has given the tree its name; its fruit is a sharp pointed cone in which the seeds are to be found. The wood, known in commerce as whitewood, is valuable, being used for building, shingles and woodenware. The trunk of the tulip tree is usually a single column—specimens with two columns, caused by the tree's forking when young, as in the splendid plant we are now studying, being exceptional. Its circumference of 19 feet indicates a diameter of about 6¼ feet, or a radius of about 37 inches. The average number of annual layers of wood to the inch in the radius of the tulip tree up to 105 years old, when the radius is 22 inches, is 4.8, as shown by a trunk recently cut at the New York Botanical Garden. If the same proportion were carried out to the radius of 37 inches of the Inwood tree it would be 174 years old. As trees become older, however, the layers of wood formed annually are thinner, so that we may assume that in this specimen the average number of layers to the inch of radius may be about 6, which would indicate an approximate age of 222 years."

The following words are to be engraved on a tablet placed near the tree, which has been protected by a high iron fence: "Tulip Tree. *Liriodendron tulipifera.* Circumference, 19 feet. Age, 225 years. Henry Hudson entered this inlet in 1609 and

may have met the Indians here who used the place for a camp, as shown by the quantity of old broken oyster shells around this tree and near by."

The many friends of Dr. G. A. Shull will be pleased to hear that he is recovering satisfactorily from an operation for appendicitis at the Skene Infirmary, Brooklyn.

Mr. Christy Michel, recently graduate student at Harvard and Ohio State University, has been appointed Professor of Botany at South Dakota College of Agriculture and Mechanic Arts.

On October 11, Prof. R. B. Thaxter, of Harvard University, known for his work on the Laboulbeniaceae, visited the Brooklyn Botanic Garden. Dr. Thaxter sailed in the afternoon for Trinidad where he will continue his work on these plants.

At the school of botany, University of Texas, Dr. I. M. Lewis has been promoted from instructor to adjunct professor and Dr. F. McAllister has been appointed an instructor in botany.

TORREYA

December, 1912.

Vol. 12 No. 12

THE HEMPSTEAD PLAINS OF LONG ISLAND*

By Roland M. Harper

There is in the western third of Long Island, within an hour's journey by rail from New York, about fifty square miles of dry land which was treeless when the country was first settled, and a considerable part of this can still be seen in its natural condition. This prairie, known locally as the "Hempstead Plains," is mentioned in a few historical and descriptive works, but long before geography became a science it had ceased to excite the wonder of the inhabitants, few of whom at the present time realize that there is not another place exactly like it in the world.

My attention was first called to it by the following statement in the U. S. Department of Agriculture's Soil Survey of the "Long Island area," by J. A. Bonsteel and others:†—"The . . . Hempstead plain is notable in being a natural prairie east of the Allegheny Mountains. In its natural state it bears a rank growth of sedge grass. It was treeless when first discovered and was originally used as commons for the pasturage of cattle and horses belonging to individuals and to communities." The

* This paper was originally read before the Association of American Geographers, December 31, 1909, and published in abridged form in the Brooklyn Standard-Union for January 16, 1910, and in full, with five illustrations, in the Bulletin of the American Geographical Society (**43**: 351–360) for May, 1911. On account of its local botanical interest, and in view of the fact that the periodicals named reach very few of the readers of Torreya, and that the area is rapidly being developed by real estate companies, we have obtained permission from the American Geographical Society to use it in Torreya. The author has here eliminated some passages which do not immediately concern botanists, and supplied an entirely new set of illustrations, none of which have ever been published before.—Ed.

† Field Operations of the Bureau of Soils for 1903, p. 99; or p. 13 of the "advance sheets" for this particular area, published in January, 1905. A somewhat similar statement occurs 27 pages farther on.

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same thing has been mentioned incidentally in the catalogues of Isaac Hicks & Son, nurserymen of Westbury, L. I., and in "Long Island Illustrated," an attractive booklet issued annually by the Long Island Railroad.

For a generation or more the Hempstead Plains have been known to a few botanists as a good collecting ground, and every one who has traveled by rail from New York to Cold Spring Harbor, since the establishment of the Brooklyn Institute's biological laboratories at the latter place, has passed through several miles of what was once prairie, and seen a little which is

FIG. 1. Prairie scene about 3 miles south of Hicksville, *Quercus prinoides* in foreground, *Quercus minor* at left, *Betula populifolia* near center. August 25, 1909.

still in its natural condition; but to this day the real nature of the area in question has apparently never been mentioned in botanical literature. Previous to the summer of 1907 I had been along the edges of the area, as defined by Bonsteel, in several places, and penetrated into it for short distances, without seeing any natural vegetation, so I supposed that the prairie was all occupied by villages, private estates, farms, etc., and that it was consequently no longer possible to verify the published statements about its original vegetation. But one day in July of that year I happened to cross the center of the area on foot, and was surprised to find that there are still thousands of acres

on which *the flora is practically all native.* This is pretty good evidence that such areas have not only never been artificially deforested, but also never been touched by the plow. Where the sod is once broken a very different flora, consisting largely of European weeds, comes in, so that areas which have ever been cultivated can be distinguished at a glance. The same is true to some extent of areas that have been too closely grazed.

The prairie occupies the central portion of Nassau County, about midway between the north and south shores of the island. Like the pine-barrens of Suffolk County, a few miles farther

FIG. 2. Looking westward across the dry valley of Hempstead Brook toward Garden City, *Myrica carolinensis* at edge of valley in right foreground. Sept. 29, 1909.

east,* it lies entirely south of the latest terminal moraine (the Harbor Hill moraine), but partly overlaps or dovetails into the older of the two Long Island moraines (the Ronkonkoma moraine). Originally it extended westward to where Floral Park now is, and eastward to Central Park, a distance of about twelve miles, and had its greatest breadth from north to south, about seven miles, very near its eastern end. North of the straight main line of railroad from Floral Park to Hicksville, and also

* See TORREYA **8**: 2. 1908.

west of Garden City and Hempstead, the original prairie vegetation has been almost totally obliterated; but a little south of Hicksville there are still a few places where one could describe a circle a mile in diameter without including a tree or a house or a field. Probably about one fifth of the original prairie area is still in its natural condition, except for being intersected by roads.

FIG. 3. Looking westward in dry valley about a mile south of Westbury Station. *Eupatorium hyssopifolium* in foreground. Aug. 14, 1909.

The surface of the Hempstead Plains, like the rest of the southern or unglaciated portion of Long Island, is for the most part very flat, and slopes gently southward at the rate of about one foot in 300. It ranges in altitude from about 60 to 200 feet above sea-level. Traversing the plain in a general north and south direction are a number of nearly straight broad shallow valleys, ten to twenty feet in depth, which are believed by geologists to have been formed by glacial streams and not by recent erosion. Within the limits of the prairie most of these valleys are now dry at all seasons, but farther south some of them contain permanent streams.

The upland vegetation of the Plains comprises about four species of trees, a dozen shrubs, sixty herbs, and a few mosses, lichens and fungi. The commonest tree is *Betula populifolia*, which in this region is oftener a shrub than a tree, and the other trees are *Quercus marylandica*, *Q. stellata*, and *Pinus rigida*,

which are scattered sparsely over the eastern part of the area. The shrubs also are most abundant eastward. One of them is a willow, *Salix tristis*, and two are oaks, *Quercus ilicifolia* and *Q. prinoides;* and nearly all grow less than knee-high. The commonest herb is *Andropogon scoparius*, a grass which is said to be also common on some of the western prairies. The herbaceous vegetation, which is almost the only vegetation between Hicksville and Hempstead, with the exception of one ubiquitous shrub, *Pieris Mariana*, covers the ground pretty closely except in the most gravelly areas, is nearly all perennial, and averages about a foot in height.

Although the prairie vegetation grows in comparatively dry and sour soil, and gets about all the sunshine and wind there is in those parts, it exhibits no extreme xerophytic adaptions. A good many species, including several of the most abundant

FIG. 4. About a mile east of Garden City, looking eastward. *Salix tristis* in foreground. Sept. 29, 1909.

ones, have decidedly canescent foliage, and about half as many are glaucous, so that the whole landscape has rather a grayish tint. A large proportion of the species have very narrow leaves, but there are no succulents, and very few evergreens. On the other hand there are of course no very large or thin leaves.

Most of the trees and shrubs bloom in spring and most of the herbs in late summer. Most of the woody plants and about one sixth of the species of herbs are wind pollinated. Most of the colored flowers are either white, yellow or purplish, and none of them are very large or noticeably odoriferous. Wind is naturally the chief agent of dissemination, but the scarcity of

FIG. 5. Scene near northeastern corner of the plain, about half way between Hicksville and Syosset, looking approximately ESE. The trees are *Quercus marylandica.* Oct. 20, 1907.

berries and the complete absence of burs, in a region so accessible to birds and mammals, is a little surprising.

The dry prairies just described cover something like 99 per cent of the area. The principal stream in the Plains is East Meadow Brook, which begins gradually, at an indefinite point varying with the wetness of the season, in one of the valleys about three miles east of Mineola and Garden City, flows nearly due south, and enters the woods about a mile from its source. Next in importance is Hempstead Brook, which flows right through the town of Hempstead. It takes its rise in a narrow strip of meadow just above the town, and its dry valley can be traced for a few miles to the northward. Still farther west there are one or two smaller streams similarly situated and bordered originally by similar vegetation, but now considerably encroached

upon by civilization. The wet meadow vegetation along these streams when viewed at a little distance does not differ much in aspect from that of the dry prairies, except that it is taller, many of the shrubs being as high as a man's head and the herbs knee-high. The species in the two habitats are of course almost entirely different, but their numbers happen to be about equal.

This prairie was originally bordered all around by forests, mostly of the oak type, but the border-line has been nearly everywhere obliterated by civilization. At some places south of Hicksville only a single row of fields at present intervenes between the prairie and the oak forest, but in most places the original boundary of the prairie could now hardly be determined within half a mile. Before the country was settled the oaks were presumably encroaching on the prairie from all sides. But in the few places where pine forests border the prairie I have never been able to determine which way the tension-line is tending to move.

The cause of the treelessness of prairies has probably been discussed in geological, semi-popular, and non-botanical literature more than any other strictly botanical problem, and perhaps even more than it has by botanists, but no explanation has yet been found to fit all cases. Some of the partial explanations which have been suggested for the well-known prairies of the upper Mississippi valley will apply as well to the one under consideration, and some will not.* In a paper of such limited scope as this it would be out of place to attempt to review all the prairie theories, or even to mention all who have speculated on the subject; and only the briefest summary can be given here.

Among the western prairie theories which will not apply on Long Island are deficient rainfall, extreme variations of temperature, and impervious subsoil. Our prairie is subject to a good deal of grazing, frequent fires, strong wind, and excessive evaporation, like the western ones, but these factors are the result rather than the cause of treelessness, so that they could hardly have

* The interesting papers of Shimek (Proc. Ia. Acad. Sci. **7**: 47–59. *pl. 4.* 1900; Iowa Geol. Survey **20**: 426–474. 1911; Bull. Lab. Nat. Hist. State Univ. Iowa **6**: 169–240. *pl. 1–14.* April, 1911) and Gleason (Bull. Torr. Bot. Club **36**: 265–271. 1909) should be examined in this connection.

determined the prairie in the beginning or fixed its present boundaries.

There are two suggestions that have been made with regard to the prairies of the Middle West which deserve more notice, though each leaves much to be explained. Alexander Winchell in 1864* summed up the opinions of most of his predecessors on the subject, indulged in some curious and perhaps not altogether essential observations on the vitality of buried seeds, and con-

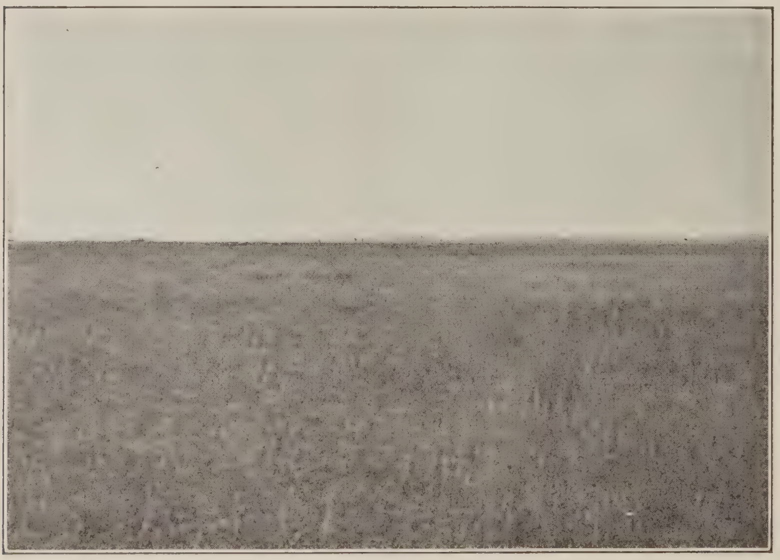

FIG. 6. About two miles east of Hempstead, looking north. Harbor Hill in distance, about 6 miles away. Sept. 27, 1907.

cluded that the "prairies were treeless because the grasses first gained foothold and then maintained it." The same idea has recently been expressed more elaborately by L. H. Harvey.† Prof. J. D. Whitney in 1876‡ distinguished between the arid plains toward the Rocky Mountains and the relatively humid prairies near the Mississippi River, showed the inadequacy of climatic theories to account for the latter, and pointed out that

* Am. Jour. Sci. **88**: 332–344, 444–445.

† Bot. Gaz. **46**: 86, 297. 1908.

‡ Am. Nat. **10**: 577–588, 656–667.

all such areas known to him were characterized by essentially horizontal strata, level surfaces, and finely divided soil. He distinguished between cause and effect, unlike some others who have written on the subject, but admitted his inability to show a causal relation between the conditions he described and the absence of trees. What he said about the topography and soil of the western prairies applies almost as well to those of Long Island* (which he probably knew nothing about), and even to some other kinds of treeless areas, such as wet meadows and salt marshes.

Although the prairies of Long Island are closely correlated with a certain type of soil, it is still an open question whether most of

FIG. 7. Looking up East Meadow Brook from the Farmingdale Road, running east from Hempstead. Aug. 25, 1909.

the peculiarities of prairie soil, here and elsewhere, may not be due to long occupation of the same ground by herbaceous vegetation. In its mechanical analysis, and even in its color, the "Hempstead loam" strikingly resembles the "Galveston clay" (an arbitrary name for a well-known type of soil, the salt marsh) described in the same government soil report; but it is probably

* Mechanical analyses of the "Hempstead loam" by the U. S. Soil Survey show that about 76 per cent of it consists of particles less than 1/20 of a millimeter in diameter, and that less than 3 per cent of it is in particles exceeding a millimeter.

a little too early to jump to the conclusion that the area in question was once a salt marsh while adjoining areas were not.

Not the least interesting fact about this unique insular coastal plain prairie is that so much of it is still in a state of nature, although it is situated in a county which has been settled for 250 years and has about 300 inhabitants to the square mile, and is all within the zone in which it is profitable to haul farm products to New York by wagon. This state of affairs is probably due to a combination of several more or less independent causes. Good crops are raised on the parts that are under cultivation, but the toughness of the sod, the thinness of the soil, and especially the scarcity of water, doubtless operate strongly to keep away new settlers unused to such conditions. That tradition has had a good deal to do with the preservation of the prairie is suggested by the following passage in the second edition of Thompson's History of Long Island (Vol. I, p. 29, 1843), which would be almost equally true today: "If the whole of this open waste was disposed of and inclosed in separate fields, the agricultural products of this portion of the island would be nearly doubled. A stupid policy, consequent upon old prejudices, has hitherto prevented any other disposition of it, than as a common pasturage. It is hoped the time is not far distant, when this extensive tract shall abound in waving fields of grain, yielding not only support, but profit, to thousands of hardy and industrious citizens."

Even if no more of this land were taken up in farms, the continued growth of New York City is bound to cover it all with houses sooner or later, and it behooves scientists to make an exhaustive study of the region before the opportunity is gone forever.

No one yet seems to have attempted seriously to enumerate, classify and explain the numerous and various treeless areas of eastern North America. If this were done perhaps other areas similar in character to the one described might be found. There are abundant hints of small prairies, open glades, natural meadows, etc., in early descriptive works dealing with parts of the country that are now pretty thickly settled, and many ex-

amples of them have doubtless already been effectually obliterated, and irrevocably lost to science.

NOTES ON THE FLORA OF NORTHAMPTON COUNTY, PENNSYLVANIA

By Eugene A. Rau

Having for a number of years studied the flora in the vicinity of Bethlehem and having made quite a large sized herbarium it was an agreeable surprise for me to notice Mr. King's Flora of Northampton Co., Pa., recently published in Torreya. In examining the list, however, I detected the omission of a number of plants which I had found at various times, and by reference to my herbarium desire to record the addition of the following together with the addition of a number of habitats.

Apparently much work still remains to be done in recording the flora in all parts of the county and designating the ranges of the various species. A thorough search will doubtless necessitate many additions to the list and thus relieve it of the too local character which it now bears.

Additions to Plants

Lycopodium lucidulum Michx. Hillsides along Monocacy, 1872.

Lycopodium complanatum L. Hillsides, Freemansburg, 1872.

Lycopodium obscurum L. On Lehigh Mt.

Equisetum fluviatile L. In shallow water, Lime Ridge, 1872.

Phegopteris hexagonoptera (Michx.) Fee. In woods, Lehigh Mt., 1871.

Asplenium platyneuron (L.) Oakes. In woods, Lehigh Mt., hillsides near Freemansburg, 1872; along the Bushkill creek, Easton, 1872.

Cystopteris bulbifera (L.) Bernh. On rocks near Illick's mill, 1898; along railroad cut near Bethlehem steel works, 1879.

Batrachium trichophyllum Chaix. Along the Saucon and Monocacy creeks.

Ranunculus obtusiusculus Raf. On small island in Lehigh River near Bethlehem.

Actaea alba (L.) Mill. In woods, Lehigh Mt., 1871.

Stylophorum diphyllum Nutt. In cultivated grounds, Bethlehem.

Phlox paniculata L. Low grounds near Hellertown, 1878.

Phlox pilosa L. Hexenkopf Hills, 1871; also along the Monocacy, 1869.

ADDITIONS TO RANGES

Selaginella apus (L.) Spring. Along the Monocacy, also near Seidersville, 1871.

Pellaea atropurpurea (L.) Link. On boulders near Illick's mill along the Monocacy, 1871; Jones' ledge along the Lehigh, 1876.

Matteuccia Struthiopteris (L.) Hoffman. On Chain Dam Island along the Lehigh near Easton, 1880.

Camptosorus rhizophyllus (L.) Link. On the rocks, Lehigh Mt., 1879; near Freemansburg, 1879; Lime ridge along the Lehigh, 1872.

Juniperus virginiana L. Hillside, Nisky Cemetery, Bethlehem.

Potamogeton perfoliatus L. Lehigh river, 1871.

Potamogeton crispus L. Saucon creek, 1872.

Vallisneria spiralis L. Lehigh river, Bethlehem.

Arisaema Dracontium (L.) Schlott. Along the Monocacy.

Ornithogalum umbellatum L. Seminary grounds near the Monocacy.

Cypripedium hirsutum Mill. Near Illick's Mill, Monocacy creek.

Hicoria glabra (Mill.) Britton. Nisky, Bethlehem, reported by C. N. Lochman.

Corylus rostrata Ait. Lehigh Mt., 1869, and along the Monocacy, 1871.

Corylus americana Walt. Fence corners along the Monocacy, C. N. Lochman.

Fagus americana Sweet. Along the Monocacy.

Quercus macrocarpa Michx. Formerly found near Nazareth from which place several trees were transplanted to Nisky Cemetery, Bethlehem.

Urtica gracilis Ait. Along the Lehigh, 1871.

Celtis occidentalis L. Cultivated and waste grounds, Bethlehem, 1871.

Sagina procumbens L. In streets, Bethlehem, 1891, 1912.

Caltha palustris L. Is rather common in low grounds along streams while *Trollius laxus* Salisb. is rare and local in the southern part of the county.

Atragene americana Sims. Hexenkopf hills, Williams Twp., 1871.

Bicuculla Cucullaria (L.) Millsp. Lime Ridge, 1868.

Draba verna (L.). Cultivated grounds, Bethlehem; also near Freemansburg, 1870.

Hamamelis virginiana L. Along the Monocacy.

Gleditsia triacanthos (L.). Cultivated grounds and Sand Island, Bethlehem.

Vicia americana Michx. Lime Ridge, 1870; near Freemansburg, 1872.

Polygala Senega (L.). Near Leithsville, 1880.

Viola pedata (L.). Lehigh Mt. and Lime Ridge, 1871.

Epigaea repens (L.). Hills near Freemansburg, 1866; also Lower Saucon Twp., 1899.

Gentiana crinita Froel. Near Illick's Mill, Monocacy, 1871 to 1879; swampy ground near Easton, E. A. Rau, in meadows near Hellertown; reported by C. N. Lochman.

Convolvulus arvensis L. College Hill, Easton, 1872, E. A. Rau; waste places, Bethlehem, C. N. Lochman, 1912.

Trichostema dichotomum L. Roadsides, Seidersville, 1877.

Solanum nigrum L. Sand Island, 1871, along the canal, 1874.

Dasystoma Pedicularia (L.) Benth. In woods along Monocacy, 1870.

Gerardia tenuifolia Vahl. In woods along the Monocacy, 1875.

Melampyrum lineare Lam. In woods, Lehigh Mt.

Leptamnium virginianum (L.) Raf. In beech woods, Monocacy, 1873–1879.

Galium circaezans Michx. Hexenkopf Hills, 1871; Nisky Hill and along the Monocacy, 1871.

Galium asprellum Michx. Nisky Hill, 1871.

Galium Aparine L. Nisky Hill, 1871.

Hieracium pilosella L. Cultivated grounds, Bethlehem.

A TRICARPELLARY WALNUT*

By William H. Lamb

A tricarpellary walnut is one that is separable into three divisions. In general walnuts are bicarpellary, but tricarpellary forms do occur, especially in our so-called "English walnut," *Juglans regia* L. The accompanying sketch shows an end view and diagrammatic cross section of one of these interesting forms.

The term "English walnut," by the way, is a misnomer, for *Juglans regia* is not a native of England at all. It is extensively cultivated in England and on the continent, but is native to southeastern Europe, Greece, Asia Minor, and China. It has been more properly called "Persian walnut."

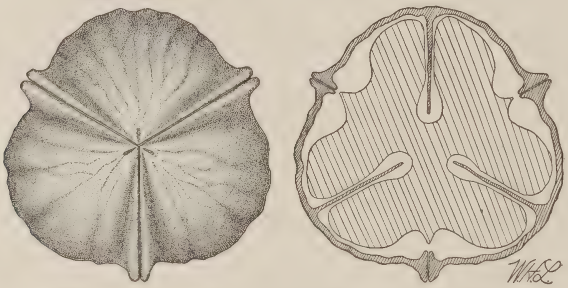

Fig. 1. End view, natural size, and diagrammatic cross section of a tricarpellary walnut (*Juglans regia* L.).

Before discussing the significance of a tricarpellary walnut, it might be well to consider just what a walnut is. A walnut is not a fruit. Indeed it is an interesting fact that no species of *Juglans* bears edible fruit. The fruit proper is a bitter, green or black, more or less fleshy drupe. It contains the walnut, just as a peach contains a large seed. If we were to throw away the fleshy part of the peach and retain the stone as a delicacy, we would be doing precisely what is done in the case of the walnut. The edible portions of a walnut are the large cotyledons.

These cotyledons are deeply lobed in consequence of an in-

* Published by permission of the Secretary of Agriculture. See also Torreya **8**: 136. 1908.—Ed.

complete septation of the cavity of the ovary. That is, the seed is divided internally by a false partition which does not completely separate the cavity into two parts, and the cotyledons are lobed and wrinkled to fit into the irregularities of the inner surface of the seed. The English walnut, then, though morphologically bicarpellary, contains but one ovule; *i. e.*, it is morphologically a true nut (one-seeded pericarp resulting from a several carpelled gynoecium).

Now what we would expect to find in a case of reversion would be a form in which this division of the ovary was complete, forming by this septation a true bicarpellary ovary, but in this specimen we find a reversion to a type in which there are three incomplete septa in the ovary, forming a nut which is separable into three parts, but which contains but one ovule, with three cotyledons. This is probably due to the fact that the reduction of the ovary in the *Juglandaceae* has been carried so far that the ovule has become basal and erect, and a complete septation of the ovary is prevented by the obstruction of the hypocotyl or upright stalk which supports the cotyledons.

PROCEEDINGS OF THE CLUB

October 8, 1912

The meeting of October 8, 1912, was held at the American Museum of Natural History. Dr. E. B. Southwick called the meeting to order at 8:30 P.M. Eight persons were present.

The minutes of May 29 were approved.

Mr. Henry O. Severance, librarian of the University of Missouri, Columbia, Missouri, and Mr. Otto Kunkel, Columbia University, New York City, were nominated for membership.

Mr. Sereno Stetson, chairman of the field committee, and Dr. E. B. Southwick reported on the field meetings held during the summer.

The application of Miss Jean Broadhurst for a grant of two hundred dollars from the Esther Hermann Fund to assist her

in carrying on her studies on the bacteria of the milk supply was approved.

The secretary read a communication from the Rice Institute of Texas inviting the president of the Torrey Club to be present at the dedicatory services of their new building.

The scientific program consisted of informal reports by various members on the collections made during the summer.

Professor R. A. Harper spoke of having collected a number of species of *Boleti* from the vicinity of Woods Hole, Massachusetts.

Mr. Stetson mentioned several expeditions which he had conducted at Copake Falls and among the hills of Connecticut.

Dr. Tracy Hazen gave a short account of his botanical investigations in Connecticut, and Dr. Southwick mentioned the work he had been doing along the line of establishing school gardens.

Dr. M. A. Howe reported progress on his work on the marine algae.

The secretary read a communication from David R. McCord, asking for information regarding the particular species of corn originally grown by the American Indians.

Meeting adjourned.

B. O. Dodge,
Secretary

NEWS ITEMS

Dr. E. D. Clark, one of the editorial board of the Torrey Club, has been appointed instructor in chemistry at the Cornell Medical College, where he will continue work on phyto-chemical problems.

The Royal Bavarian Academy of Science has awarded its medal of merit to Dr. C. C. Hosséus for his work on the flora of Siam.

A course of lectures on cryptogamic botany will be given this winter by Professor A. Vincent Osmun, of the Massachusetts Agricultural College, at the Museum of Natural History, Springfield, Mass. A similar course in general botany was conducted

by Professor Osmun last winter. These lectures are free to the public.

A statement in *Science* early last summer to the effect that the *Flora brasiliensis* was to be found only at the University of Illinois, Harvard, Columbia and the Missouri Botanical Garden has been widely copied. Final returns indicate that this valuable work is also in the following libraries: Parke Davis & Co., at Detroit, Academy of Natural Sciences at Philadelphia, Ohio State University, Peabody Library and the library of Captain John Donnell Smith both at Baltimore, and at the Library of Congress.

The University of Florida and the Florida Agricultural Experiment Station were honored by a visit from Prof. Hugo de Vries in October. After spending a week at this institution he left for a visit to the Keys along the Over Sea Railroad between Miami and Key West. During his Florida exploration Professor de Vries was accompanied by Dr. J. K. Small, of the New York Botanical Garden and Dr. P. H. Rolfs.

Dr. H. S. Reed, of the Virginia Polytechnic Institute, will sail for Italy early in January. He will spend some time at the Zoölogical Station in Naples and carry on some work in one of the German universities during the summer semester.

Dr. A. M. Ferguson, of Sherman, Texas, has a collection of Texas plants, in quantity, for making up into fasicles. Any one interested in the naming, arranging and sale of such material should write to him.

Dr. N. L. Britton, accompanied by Mr. Stewardson Brown, of the Academy of Natural Sciences of Philadelphia, sailed for Bermuda on November 27 to continue their studies on the flora of that island. Dr. F. J. Seaver has gone with the party to study the fungi of the island. The expedition will sail for New York on December 16.

We learn from *Science* (November 15) that Professor M. L. Fernald, of the Gray Herbarium, delivered a lecture at Chicago, before the Geographical Society, on November 8 on "The

Mountains and Barrens of Newfoundland and the Gaspé Peninsula."

Dr. Herbert J. Webber, of Cornell University, has returned from an extensive trip in the West, where he has been delivering lectures. He spent some time at the University of California, where he was offered the post of director of the citrus experiment station and Dean of the Graduate School of Tropical Agriculture. He has not decided whether he will accept the position.

On Monday, November 25, Rutgers College heard a lecture on the Luther Laflin Kellogg Foundation by Professor Hugo de Vries, director of the Hortus Botanicus at Amsterdam, Holland. Professor de Vries discussed "A New Conception of the Evolution Theory." Professor de Vries while making a study of the botany of Florida visited Crescent City where extensive citrus groves in full bearing were examined. In the region around Satsuma he visited the 700-acre camphor orchard, this being of special interest to him from the fact that the trees are all seedlings from seed gathered in Florida.

From *Science* (November 22) we learn that Doctor Jacques Huber, director of the Goeldi Museum of Natural History and of the Botanical Garden of Pará, Brazil, has been visiting the scientific institutions of the United States.

Mr. Henry Groves, who with his brother, Mr. James Groves, is the author of important contributions to botany, died in London on November 2, aged fifty-seven years.

At Cleveland, December 30–January 4, the American Association for the Advancement of Science will hold its annual meeting. Dr. C. E. Bessey, the retiring President, will introduce the President of the present meeting, Dr. E. C. Pickering. The botanical section, G, will hear the vice-presidential address of Professor Newcombe on "The scope of state natural surveys." Botanical societies meeting at Cleveland during the same week include, The Botanical Society of America, Botanists of the Central States, American Phytopathological Association and the Association of Official Seed Analysts.

From the *Evening Post* (November 23) we learn that the post of research assistant on the staff of the Missouri Botanical Garden, made vacant by the resignation of Dr. R. R. Gates, has been filled by Dr. George R. Hill, who received his undergraduate degree from the Utah Agricultural College. Miss Margaret De Merritt, of New Hampshire College; A. R. Davis, of Pomona College; L. O. Overholz, of Miami University; J. S. Cooley, of Randolph-Macon College and Virginia Polytechnic and W. H. Emig, of Washington University, are the Rufus J. Lackland research fellows in the Henry Shaw School of Botany during the present year.

H. E. Stevens, pathologist to the Florida Experiment Station, has definitely established, according to Professor P. H. Rolfs, the fact that *Phomopsis Citri* Fawcett is the causative agent of melanose in *Citrus* trees.

Dr. Wilhelm Miller, for many years editor of *Country Life in America*, and co-editor with L. H. Bailey of the *Cyclopedia of American Horticulture*, has severed his connection with Doubleday, Page and Company to accept the position of Assistant Professor of Landscape Architecture at the University of Illinois.

Mr. W. G. Stover, recently at the Oklahoma Agricultural College, has been appointed instructor in botany at the Ohio State University, Columbus, Ohio.

Nevada S. Evans, graduate of the University of Minnesota and expert in the seed laboratory of Northrup, King & Co., has accepted the position of Assistant Botanist in the North Dakota Agricultural Experiment Station, and will report for work in the Pure Seed Laboratory of that institution December 1.

Professor E. S. Reynolds, of the University of Tennessee, Knoxville, has accepted the position of Associate Professor of Botany at the North Dakota Agricultural College. Mr. Reynolds took up his new work at the Agricultural College, November 1.

A hundred Kny charts have just been added to the botanical equipment of Baylor University, Waco, Texas.

We learn from the *Times* (December 5) that Dr. William Armstrong Buckhout, Professor of Botany and Horticulture at the Pennsylvania State College, and one of the oldest members of the faculty, died in Philadelphia on Tuesday, December 3, at the age of 61 years. He was a Fellow of the American Association for the Advancement of Science and of many other scientific societies. Dr. Buckhout had held a professorship since 1871.

A. Anstruther Lawson (Ph.D. Chicago, 1902), who has been a member of the botanical staff of Stanford University, and, more recently, of the University of Glasgow, has been appointed professor of botany in the University of Sydney, New South Wales.

INDEX TO VOLUME XII

New names and the names of new genera and species are printed in **boldface type.**

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BY

NORMAN TAYLOR

JOHN TORREY, 1796–1873

CONTENTS

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The Torrey Botanical Club

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OTHER PUBLICATIONS

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(1) BULLETIN

A monthly journal devoted to general botany, established 1870. Vol. 38 published in 1911, contained 570 pages of text and 35 full-page plates. Price $3.00 per annum. For Europe, 14 shillings. Dulau & Co., 37 Soho Square, London, are, agents for England.

Of former volumes, only 24–37 can be supplied entire; certain numbers of other volumes are available, but the entire stock of some numbers has been reserved for the completion of sets. Vols. 24–27 are furnished at the published price of two dollars each; Vols. 28–37 three dollars each.

Single copies (30 cents) will be furnished only when not breaking complete volumes.

(2) MEMOIRS

The MEMOIRS, established 1889, are published at irregular intervals. Volumes 1–13 are now completed; Nos. 1 and 2 of Vol. 14 have been issued. The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly. A list of titles of the individual papers and of prices will be furnished on application.

(3) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

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